The UNESCO Courier

A WINDOW OPEN ON THE WORLD

JULY-AUGUST 1961 (14TH YEAR)

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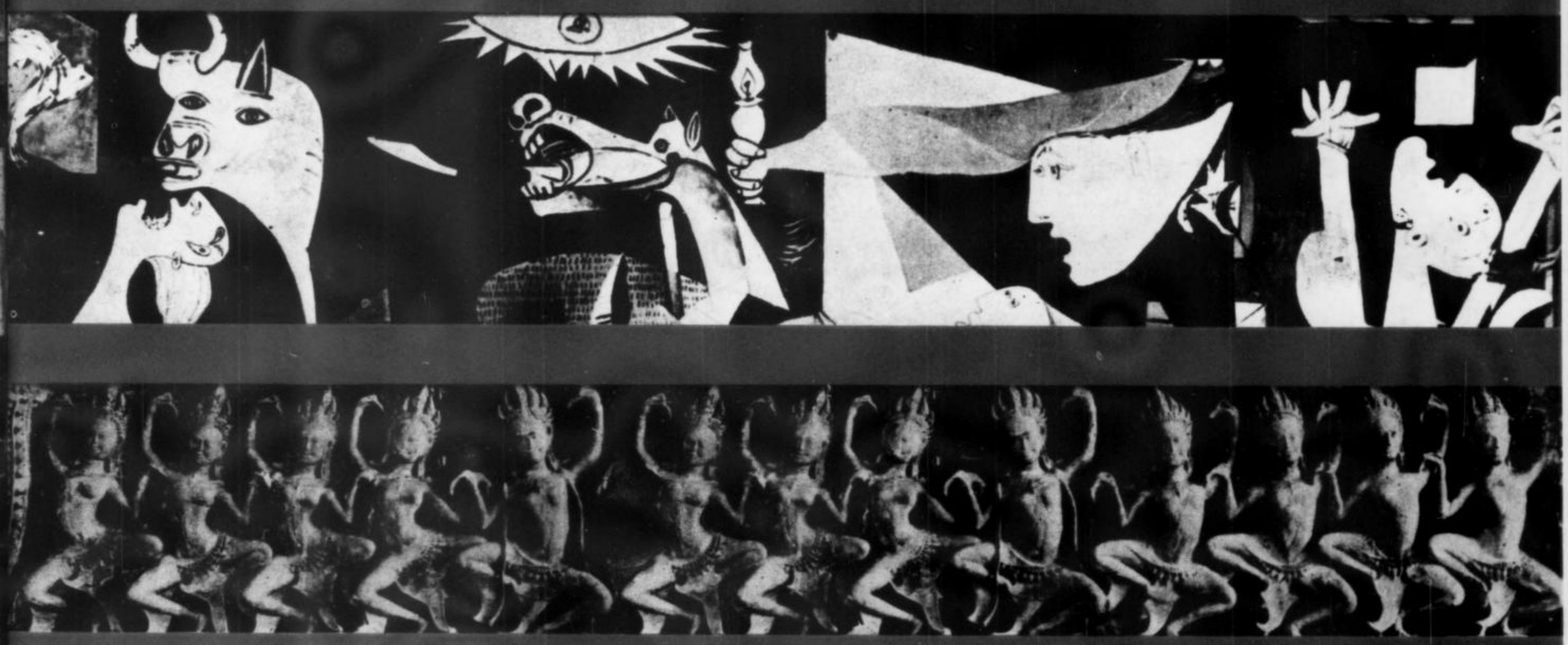
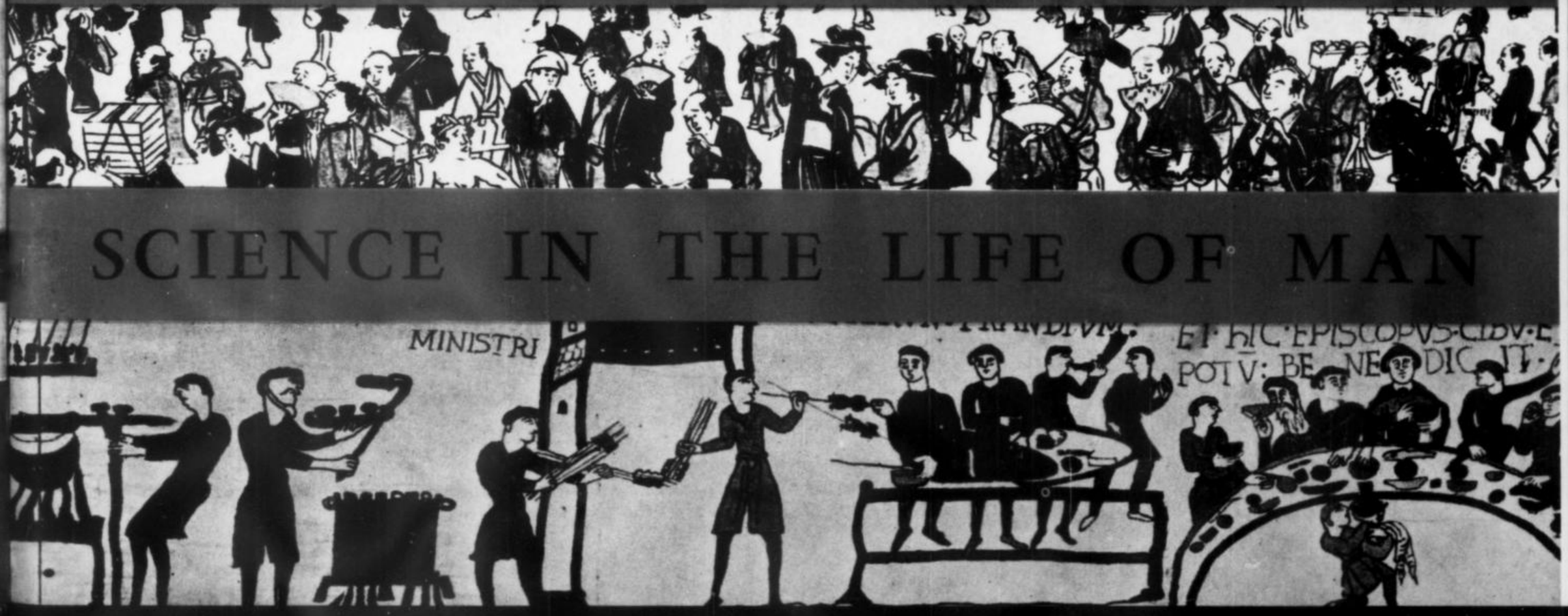
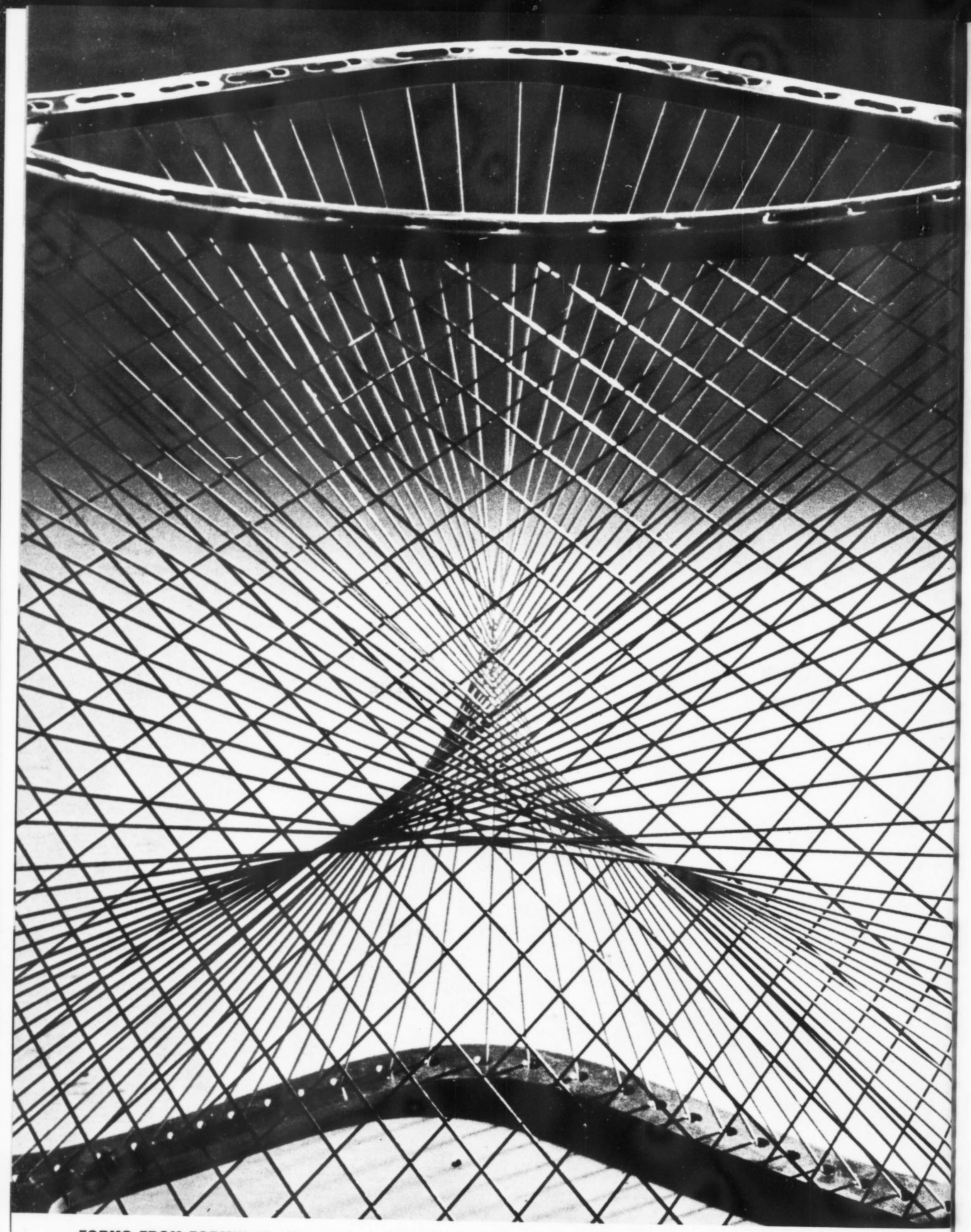
ART IN THE LIFE OF MAN



SCIENCE IN THE LIFE OF MAN





FORMS FROM FORMULAE. This photo looks like the work of a modern abstract artist. In reality it is the three-dimensional projection of a mathematical formula, known as Plücker's conoid. It is displayed in the Mathematics Hall of the Palace of Discovery, Paris. See page 24.

(c) Paul Almasy, Paris

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JULY - AUGUST 1961
14TH YEAR

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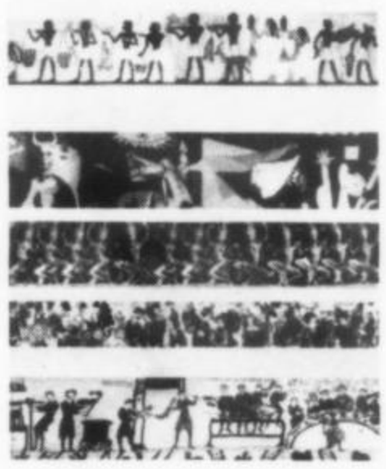

COVER PHOTO

The human figure has been a favourite subject for artists of all ages. On the cover, from top to bottom : (1) A procession from an ancient Egyptian fresco. (2) Section of Picasso's Guernica. (3) Frieze from Angkor Thom temple (4) Detail of Japanese painting of market scene, Hokusai school. (5) Section of IIth century Bayeux tapestry, France. (See page 4.)

Photos © Bulloz, Giraudon, Paris

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Unesco, Place de Fontenoy, Paris 7e, France

Editor-in-Chief
Sandy Koffler

Assistant Editor
Gordon Behrens

Associate Editors
English Edition : Ronald Fenton
French Edition : Jane Albert Hesse
Spanish Edition : Arturo Despouey
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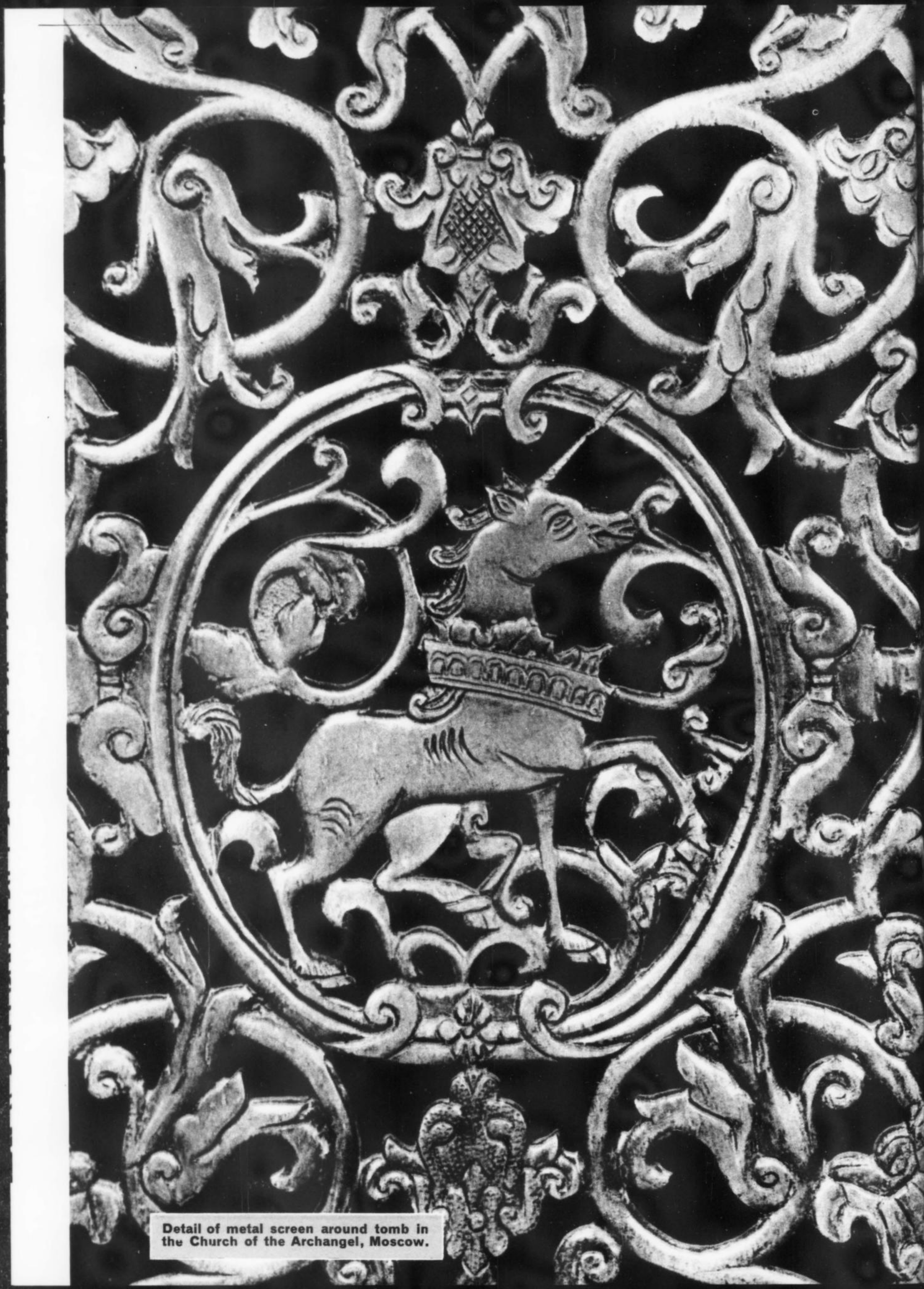

Detail of metal screen around tomb in the Church of the Archangel, Moscow.

ART IN THE LIFE OF MAN

by Dr. d'Arcy Hayman

Head of Arts Education Section
Arts and Letters Division, Unesco

Anatomical study, Leonardo da Vinci.
Photo © Anderson-Giraudon, Paris

'Treating the commonplace with the sublime gives art its true power'

Jean-François Millet

EVERY child, every man, every culture gives form to its feelings and ideas through art. Art is the essence of that which is human; it is the embodiment of the human experience and goal. From the moment in our history when man became distinguishable as man, art was the mark that distinguished him, and ever since, man has continued to be an artful creature. The art act and object provide constant evidence and demonstration of the human act and objective.

In this contemporary world of growing technology, man views his place along the path of human activity with mixed feelings of pride and doubt. The promise of a tomorrow liberated by human imagination and devotion yet threatened by narrowness, coldness, disintegration, puts man at a crucial point in time and space at which he must carefully re-examine and re-assess the values by which he lives. It is especially important now that we carefully examine the vital functions of the arts in culture and give renewed attention and emphasis to the inherent contributions of the arts to the survival and development of man.

A culture gives evidence of the will and participation of the individual. Art functions in a society much as it functions in the life of an individual. It becomes the emblem of a group, just as it is the mark of a single man. It is a universal and personal implement with which men protect and liberate themselves. It is a plan by which the crowd and the man apart from the crowd can make coherent the fragments of existence. It is an all-embracing sentiment that brings men together, preserving for them, still, their uniqueness. It is a moment in time when every child and every man is beautiful and fulfilled. Art is a dynamic, ubiquitous source which serves human need and manifests the human potential.

ART can and should be an experience shared by all men every day of their lives; this does not mean that all men must be painters, architects, authors, composers, nor does it mean that men must spend all their evenings in theatres and concert halls. Rather, it means that man's innate sensitivities to the arts must be allowed to develop, and, by early encouragement and education, must be given opportunity for growth so that the whole man can emerge.

The art experience embraces all forms of involvement with art: the production of works of art on the part of the professional artist, the primitive craftsman, the layman, the child, as well as the active appreciation of art on the part of the universal art audience which looks at, listens to, reads and uses the work of art with personal interest, understanding and love. The ultimate dimension of the art experience is that which enables each man to become aware of the aesthetic of his own environment, brings to his attention the endless excitement of form and colour, the richness of texture, the force, rhythm and sound of human interaction, the poetry of nature and man.

In the complexity of a modern world, it has become necessary for men to "specialize" in their vocations, their work. As a result, the human disciplines of art and science, of philosophy and technology, have been separated, to the detriment of each. This twentieth century phenomenon is at the peril of man, himself. It is as if man had attempted to sever his head from his body in order to isolate one faculty of his being from another.

Leonardo da Vinci lived in an age when one man could embrace both fields of investigation simultaneously. In the tradition of most oriental cultures, we find that a man, whether he be statesman, businessman, or scientist, in order to be considered a complete man, a whole man, must have an intimate understanding of and sensitivity to the arts. As art and science reach their purest form, the parallel objectives, experiences, procedures, and end products, almost merge into a single image, with the scientist crediting his own intuitive senses and the artist discussing problems of energy and matter.

Albert Einstein has said :

> Man tries to make for himself in the fashion that suits him best a simplified and intelligible picture of the world; he then tries to some extent to substitute this cosmos of his for the world of experience, and thus overcome it. This is what the painter, the poet, the speculative philosopher and the natural scientist do, each in his own fashion. He makes this cosmos and its construction the pivot of his emotional life, in order to find in this way the peace and security which he cannot find in the narrow whirlpool of personal experience.

But in these words of Einstein, we cannot overlook the phrase "each in his own fashion", for here is the key to the difference between art and science. It is true that the realm of science, like art, offers man an area in which his imagination is given free rein, and it is even possible for the man of science to arrive at his answers intuitively, just as the artist does. But the paths to scientific and aesthetic solutions differ greatly, and the final products of each effort manifest these basic differences. The fact that art is different from all other fields of human endeavour makes it irreplaceable and indispensable in the life of man.

Art functions in man's life in many nameless ways. In any analysis of the role of art in human existence, one can only attempt to describe those qualities of the art experience that appear, at a specific moment in time and space, to be of particular value to man. Each individual, each culture, each age, will arrive at different points of

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© Giraudon, Paris

Detail of Old Man Seated, by Rembrandt. From the Gulbenkian Museum, Lisbon.

'Fine art is that in which the hand, the head, and the heart go together'

John Ruskin

In a graceful line-up, young Danish ballet students execute a difficult tip-toe exercise.

© Photo and Feature, Copenhagen

© Paul Almasy, Paris

As they work, craftsmen like this designer producing a floral motif on glass, discover new possibilities within their materials.

Painting offers these children of nursery-school age a medium for free and uninhibited expression. For children art is a way of discovery.

USIS

'Art is science in the flesh'

Jean Cocteau

emphasis according to its own need and history. It is even true that a work of art produced to satisfy one human need in one period of time can function in an entirely different way in another culture.

The best one can do when one hopes to verbally clarify and classify the functions of art, is to attempt to single out those ways in which art seems to be of significant value to human existence and development at a particular moment. Other men in other times and places have described and will continue to describe the functions of art differently, for art, like man, is ever changing, ever evolving and becoming, ever new. But let us now (speaking out of our own frame of reference) consider those ways in which art functions in the life of man.

To be alive is to be aware, curious, active, sensitive, productive, adventurous, concerned, involved. To be dead is to be none of these things. Art increases our state of aliveness by expanding and deepening our state of awareness. Jean Cocteau once commented that to write is to kill something of death. Art discovers, heightens, and refines life experiences; it brings our emotions to our attention and makes us fully feel them. Art is a selection and examination of the physical and social world in order that we may apprehend in ideal simplicity the selected properties and values usually evident only obscurely, if at all, in ordinary experience. Art serves to clarify our feelings. Until we express emotions we do not know what they are. The artist's vision, both analytic and panoramic, makes perceptible at once the parts and the whole.

It has been said that man does not create; he regenerates. Perhaps this means that man does not actually create new forms, new orders, new life; rather, he discovers the fundamental forms and processes of his universe and gives them new energy and function. What we call "creativity" in human beings may, in fact, have to do with that human discovery of a pre-existing fact, a "cosmic truth".

PERCEPTION involves that discovery which man makes about his environment conditioned by his past experience; it is the combination of the physical make-up of the object in relation to the symbolic associations made by human minds and senses. Discovery in and through art includes not only that finding the artist makes about his work, but the discovery the work of art makes about him. The work of art sums up and reflects the discoveries the artist has made about his environment and about himself. For the child, as for the man, art is a way of discovery which leads to new understanding of the physical world in which he lives and of the self; it gives new meaning and significant form to his life.

The life experience of man is a concert of involvements. The degree to which a human being involves himself with life differs according to the kinds of things that determine and shape the moments of his existence. Art intensifies man's involvement with life; it gives evidence and symbol of human energy; it clarifies, vivifies human experience.

Art deals with the emotional realm of man; it supplies stimulus for his capacity to feel and react, it expands his

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'All arts are brothers— each one a light to the others'

Voltaire

area of sentiment. The art experience sharpens and rewards the senses, and thus it develops all human faculties.

It is the function of art to develop man's ability to feel and to know beauty. Delacroix wrote in his diary: "In many people the eye is untrue or inert; they see the objects literally; of the exquisite they see nothing."

But when we speak of beauty we must be careful to point out that concepts of beauty change and manifest themselves differently according to the culture, the time, the individual. Both classical Greek and African primitive art are beautiful; both Oriental and Occidental music are beautiful. But concepts of beauty in these cultures differ. We can easily appreciate standards of beauty that are familiar to us, but it is with more difficulty that we develop an appreciation of other kinds of beauty than our own.

© Leforest, Paris

Bahnar cemetery statues, in southern Viet Nam.

Mosaic from the Sforza Castle Museum, Milan.

© Bulloz, Paris

We meet the same difficulty when we consider the difference that time makes upon our notions of what is beautiful. It is well known that many of the artists whom we now list among "the great masters" were considered radical, ill equipped, even mad for their own daring to express an individual concept of beauty which was too advanced for their time. Rembrandt, El Greco, Blake, Rodin, Van Gogh and countless other artists, composers, poets were criticized, ridiculed or ignored in their time. Whole periods of art were similarly berated: "Gothic" was a name applied to the art and architecture of mediaevel times in depreciation by Renaissance scholars who considered it crude and ugly.

The problem is ever the same. Today, that which is called "modern art" or "abstract art" is met, in many parts of the world, with public indignation and bewilderment. It is true that new forms of art are difficult to evaluate because they often require new criteria for evaluation, new standards for judgment. Surely not all of our contemporary paintings, architectural structures, musical and literary works will survive the critical perspective of time. But we must trust that time will select out of our age those key works which intensify our moment in history and become part of the next generation's visual landscape.

One of the greatest problems in our contemporary civilization is the inability of large numbers of people to commit themselves wholly and intensely to an ideal, a cause, an objective. Where once the mark of youth was vitality, courage, energetic involvement, we now find growing numbers of the young people of the world drifting carelessly into a gutter of nothingness and decay.

Art is among the human disciplines that allow for and depend upon the intense commitment of man to constructive action.

A problem assuming gigantic proportions in our new technological world is that of "mass leisure". Men once dreamed of the day when physical slavery would be abolished, when the common man would work at the necessary tasks of the society for a minimum amount of time, to be released from these chores to enjoy a great portion of his life in leisure. That day is gradually coming

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Woman in Tears, by Pablo Picasso
Collection Roland Penrose, London.

Classical Kabuki dancer, Japan.

© Bulloz, Paris

Mythological figure, Pre-Inca Chimu civilization, ancient Peru.

Woman at work.
Indonesian wood carving.
Basel Ethnological Museum, Switzerland.

African wooden statuette.

© Bulloz, Paris

'Man is tougher than iron, harder than stone and more delicate than the rose'

Turkish proverb

Joan of Arc. Painting by Georges Rouault. Museum of Modern Art, Paris.

© Bulloz, Paris

Indian National Museum, New Delhi

The love story of Radha and Krishna is an epic theme of Indian miniature painting. Thousands of works were done recounting this story. Here, a 17th century work in northern Indian style

for a large measure of the world's people. Instead of bringing the utopia it promised, new problems are growing. Men feel an emptiness and bewilderment at suddenly acquiring large blocks of leisure time without the psychological preparation and education for it.

As a result of this new technological gift, television sales have zoomed, entertainment has become a four thousand million dollar a year business in America alone, but along with these statistics we can find that the rate of alcoholism, drug addiction, mental illness and juvenile crime has risen to alarming proportions. The "threat of leisure" is the result of a new class of people who have successfully fought and won the battle of rights and privileges for the working man only to fall into the aimless and decadent pattern of playboys.

The role of art in education has great meaning here. The art experience which involves the feelings of children and men encourages incentive and allows for commitment. Art makes leisure time and all time a thing of meaningful excitement and beauty. The challenge of art is to enflame and intensify in order to evoke deep emotional and intellectual responses united with those responses felt by human beings in their relationships of man to nature and man to man.

Art is that area of human experience which encompasses expressive activity. Storytelling, celebrating, acting, singing, painting and dancing are the fruits of man's need for expressive activity. We often classify cultures upon their expressive activity alone. Different societies may have the same mores and the same work habits, but if their art is different, the societies are different.

Self-expression, as manifested in art, distinguishes individuals, as well as cultures. Man's life differs from that of most other organisms in that individualization has become more important to him than strict conformity to type. Individual capacity, viewpoint, choice, and action are qualities that make us human. Sartre in his existentialist philosophy presents a strong plea not to forget that individual men and women and children are neither machines nor logical terms. We cannot find them, nor can they find themselves merely in systems, either political or metaphysical. We cannot explain them by stereotypes. Each individual living with "nothingness" at his heart must fill that void in his own way.

The human individual is solitary and unique. As such, each is irreplaceable; to understand him is each time a new problem. We must come to a place where we are able to apprehend a person in his uniqueness, to understand what makes him different from everyone else. Sartre has established one absolute value for man: freedom. Freedom and free choice are man's duty as well as his natural condition. A person not only may make his life significant by living according to meanings and values which he has chosen, but he ought to do so.

Man can and should renew himself each moment through his capacity for free choice. Chekhov once said that his aim in life was to squeeze the slave out of himself. In a letter to a friend he described himself in youth as one who was brought up to fawn on rank and accept without questioning other people's ideas, one who behaved hypocritically toward God and man without the slightest excuse but that he was conscious of his own worthlessness. As a man, Chekhov was able to find his worth, his purpose, in his art and the opportunity it gave him for personal expression.

Art expression enables man to see himself and communicate with himself for it gives voice to the self. The artist's product makes the man unique as much as his thumb print and signature single him out. The artist does not deal in categories but in particulars, and he deals directly with them. This individuation of experience, of emotion, is made possible through art.

Anthropologists and archaeologists have estimated that it was just about a million years ago, at the beginning of the Pleistocene period, that man emerged from the world of primates. There have been many attempts to describe and identify the human characteristics of man. But whatever the historian's conclusions, they are always based, in large measure, upon the artifacts and aesthetic expressions which automatically reflect the individual and his particular time and culture.

One of the distinguishing features of the human spirit is its need to record personal and group experience. The finger-tracings, drawings, engravings, bas-reliefs and paintings on the walls of caves inhabited by earliest man tell a clear and direct story about the dawn of human

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'Art is the one way possible of speaking truth'

Robert Browning

culture. The historian knows that the art of every age and every culture is an outgrowth, an extension of that age and culture. There is no more accurate description of a certain time and place than is given to us by the artifacts we find from the remains of that civilization. When we trace the history of man up to current times we can find recorded and reflected in the art work of each period the life and death, the beliefs and fears, the joys and sufferings of human beings.

The work of art stands as summary and chronicle of human experience. Man still has need of leaving a record of his life experience. But many a man or child is frustrated in his attempts to manifest his observations in the complicated and abstract signs and symbols of a highly technical society. Record making in the natural and personal symbols of art enables all men, all children to record the uniqueness and significance of their own lives.

One of the greatest of human gifts is the highly developed capacity to communicate; it is in the act of communication that men can relate themselves to other men near and far in time and space. For the purpose of communication men have invented symbols, and this symbol-making function is one of man's primary activities; in fact it is the fundamental process of the mind and goes on all the time. This process actuates human aims, fancies, consciousness of value, awareness and enthusiasms.

© Bulloz, Paris

Chinese landscape painting, now in the Musée Guimet, Paris

S. I. HAYAKAWA has said that the task of art is perpetually to search for emblems with which adequately to symbolize and thus to enable us to cope with our experience. Symbol making is basic to man. Man must record his experiences and feelings in symbols in order to communicate them to other men. A whole system of communication sprang from the earliest drawings and paintings. The alphabet and all written language are outgrowths of these earliest recorded images.

The visual and musical arts offer man means of communication that go even beyond the scope of words. The painter, the composer have invented symbols that can be passed from man to man so that concepts and feelings can be conveyed directly.

Just after the turn of the century, Kandinsky wrote one of the first explanations of "non-objective" art as a means of communication. Kandinsky drew upon his own first art experience in music as a basis for his argument that form and colour in themselves constitute a language adequate to express and communicate emotion just as musical sound acts directly on the soul. He believed that it was not necessary in the visual arts to have the kind of material subject matter found in literature. Form itself is the expression of inner meaning.

Art as a tool, as a medium of communication has many implications for the life and education of man. In these times when the development, even the survival of man, depends upon full and successful intercultural communication we cannot afford to overlook or ignore any area or form of communication. The aesthetic level of human interaction is one which is indispensable in the life of all persons.

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Executioner preparing the cross. By Albrecht Dürer, Bonnat Collection

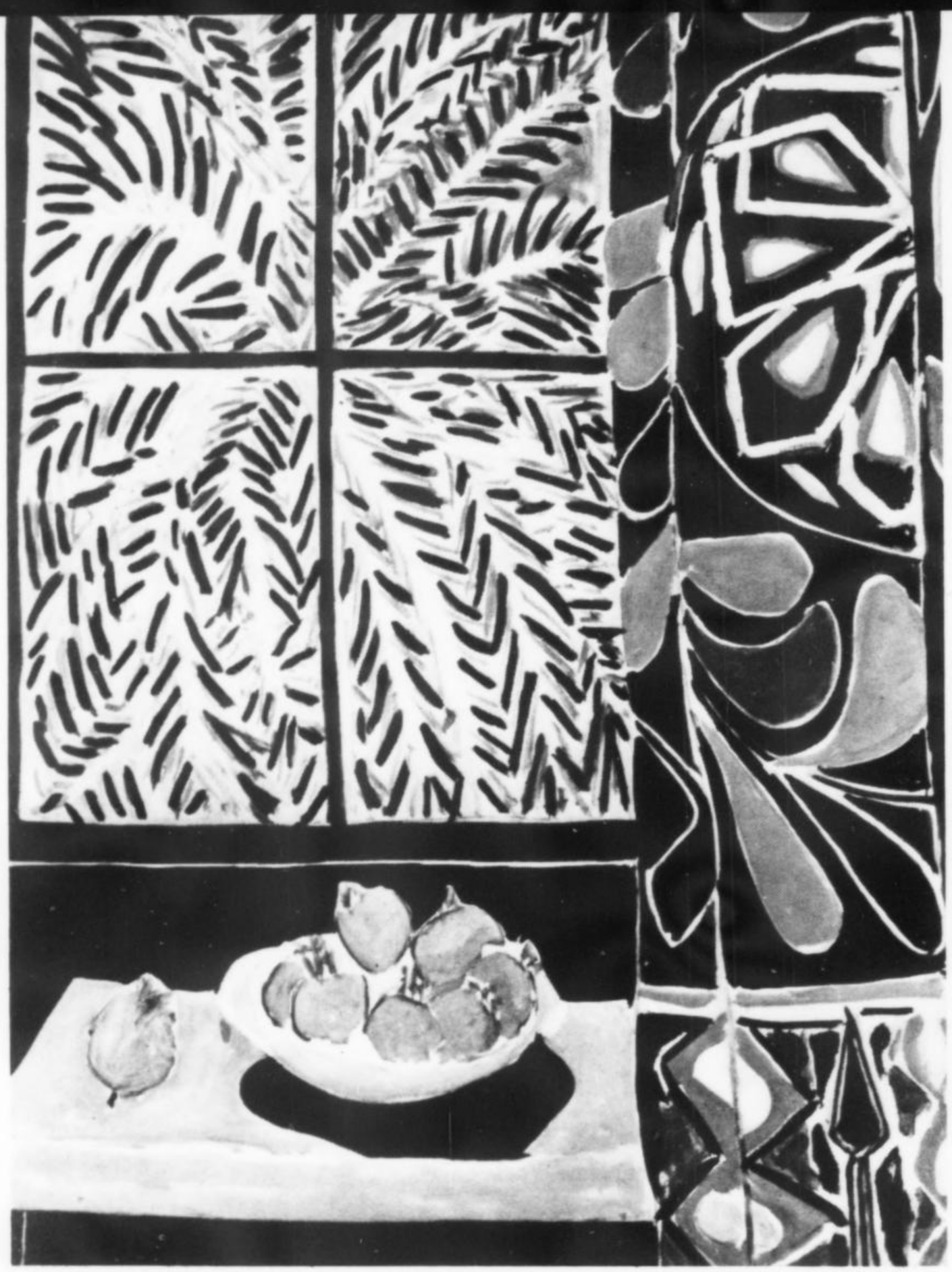
© Bulloz, Paris

Starry Night, by Vincent van Gogh, now in Museum of Modern Art, New York.

© Giraudon, Paris

Unesco - Marc Riboud

Buddhist sculpture, on wall of Borobudur Temple, Java.



Interior with Egyptian Curtain, by Henri Matisse.

The Phillips Gallery, Washington

Unesco-Laurenza

Hieroglyphic carvings,
Great Temple of Abu Simbel, Egypt.

© Photothèque, Musée de l'Homme, Paris

© Beuteli-Verlag, Berne

Intention, a painting by Paul Klee.

'Art hath an enemy called ignorance'

Ben Jonson

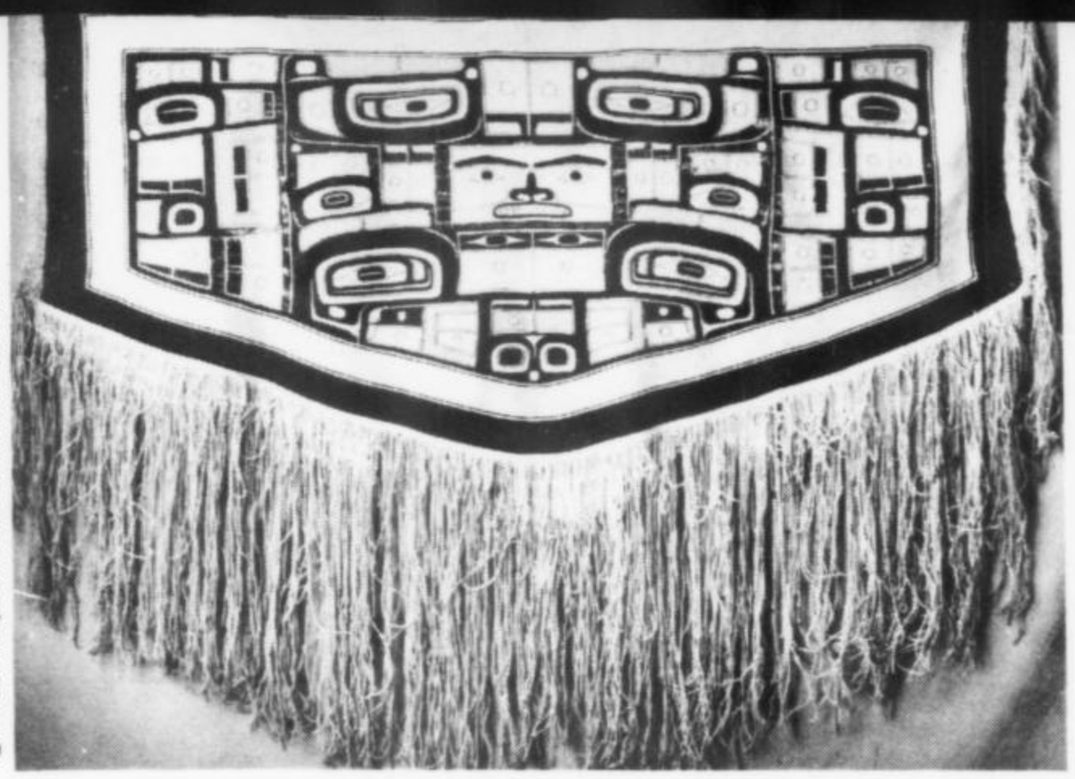
If, in the human order of things, each man is an individual with a particular set of senses and special arrangement of capacities, then each man's vision is different, and the record each makes of his life and environment will be a unique interpretation.

All of the arts are formed upon a set of basic symbols. Music, language, painting, involve abstractions that live as separate and self-contained entities, but when these symbols are long studied and learned, they act as a magnifying glass, a microscope which is turned back upon ourselves. Art makes fundamental relationships visible to the half-closed eye. Caught up in the complexity of civilizations man often loses sight of his human objective. The artist then not only records the physical facts of his being, but must act as interpreter, translator of the human experience. Art acts as diagnosis, definition, and rationale for the human condition.

The Pyramids of Gizeh, the Parthenon, the temple of Vishnu, the cathedral at Chartres, the United Nations buildings stand, not only as a record of the time out of which they were built, but as translations of that time. The paintings of Giotto, Rembrandt, Tung Yuan, Grunewald, Miro, Pollack, de Kooning are highly personal, yet they become universal interpretations of human experience.

Art does not stop at recording natural facts; art, as the Swiss thinker Amiel once said, reveals nature by interpreting its intentions and formulating its desires. Artists do not merely record what they see; they have always put themselves and their culture and their age into their art. African sculpture is filled with the great power and dignity of the African people. We can look back at the magnificent art of Egypt and see how the artist's pictorial representation took in all he saw and believed; we see how the Greeks breathed life into their schematic forms, how mediaeval man brought his own passion and devotion to the art forms he produced, how Chinese and Japanese artists have reflected the contemplative quality of their culture. And the contemporary artist in all cultures endeavours to select out of his experience those salient observations and felt responses in order to interpret them for others through his craft.

In speaking about his friend, Picasso, Jean Cocteau once said: "...he never let himself be bothered by external



© Photothèque, Musée de l'Homme, Paris

Woven cloth design, Tlingit Indians, Alaska and N.W. Canada.

© Bulloz, Paris

Painted canvas, Chimu Indian civilization, Peru.

© Milos Hrbas, Prague

Arabic lettering on the grave of Shah Zindeh, a 14th century shrine in Samarkand.

views: they are after all simply the field which he harvests, for he is a harvester. He is an inspired ragpicker, the king of ragpickers. He picks up whatever lies in his path and makes it serve him." The artist acts not only as translator of his individual experience, but as interpreter of the whole human experience as well.

The artist consciously or unconsciously seeks to change and improve upon the human condition. When all things as they are please a man, the stimulus toward creative activity is absent. Whatever the designer's area, the painter's subject, he, as a member of the human race, is concerned with the betterment of mankind. The architects of our time, Le Corbusier, Mies van der Rohe, Frank Lloyd-Wright, Nervi, Neutra, Buckminster, Fuller and others, are profoundly concerned with human progress. They devote their energies to the study and meeting of human needs and problems.

Schiller wrote this shortly before he died: "One of the most important tasks of culture is to submit man to the influence of form... to make his life æsthetic by introducing the rule of beauty wherever possible; because only from the aesthetic can morality develop".

The painter and the sculptor have long been actively engaged in social and spiritual reform. Goya and Daumier and Orozco, who etch upon our eyes and mind appalling moments of man's treachery; Kirchner and Munch and Bacon, who point out the problems of a civilized society—all contribute, along with the philosophers and statesmen and scientists, to social reform within the human society.

The artist traditionally has taken part in many kinds of reformation, for it is the very essence of his craft to "re-form" his environment. When we view the word in this original sense we can see that the artist is the master of reform; he takes the pigments and fibres and wood and clay and rock and metal from their natural organic and inorganic states and gives them new form; he takes the everyday visions and values of men and "re-forms" them as well.

Perhaps the most elusive quality of man is that which we call the spiritual. We cannot locate its source in the physical make-up of men, but we know that the human spirit is one of the things that defines the human being. Spiritual reform is one of the tasks of the artist. Today's painter attempts to escape the superficial, to penetrate the façade, and to enter into the realm of the spirit of man. Just as the Haiku poet endeavours to express a cosmic truth in seventeen syllables, the painter, with poetic economy, strives to capture the universe in a rain drop.

Charles Morris has written: "Art is the language for the communication of values... art does not, except incidentally, make statements about values, but presents values for direct experience ; it is not a language about values, but the language of value."

Art enhances life. Just as the artist, by his very act, attempts to alter his environment, he also seeks to enrich

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'All the arts relating
to human life are linked
together by a subtle bond'

Cicero

it. Art can touch every phase of human life and make it that much more comfortable and beautiful. The art products that serve our physical needs, our clothes and furniture and automobiles should function as utilitarian as well as art objects. The art products that meet our intellectual-emotional-spiritual needs, paintings, sculpture, the ceremonial vase, the tapestry, the book illustration, the film, the flower garden, serve other human requirements. But all of art serves man's aesthetic needs, and aesthetic needs are common to all. Thomas Aquinas said: "The senses delight in things duly proportioned as in something akin to them; for the sense, too, is a kind of reason as is cognitive power."

Aesthetic pleasure has been the source of productivity in art since prehistoric times. The "home art" of Magdalenian man included delicate engravings on utensils and tools; at the same time Central and North American men dyed and decorated the animal skins they wore, painted intricate motifs on their canoes. Wood carving, basketry, pottery, leather work, and jewellery making are among the first accomplishments of man. When we look at the magnificent use of colour and form in an ancient Peruvian textile or in a Zuni jar of the North American Indians we become aware of man's earliest need to act upon, control, change and enhance his environnent.

The gardens of Villa d'Este, the canals of Venice, Leningrad and Bruges, the tapestries of the Lady and the Unicorn, the Angkor Wat carvings of Cambodia, the Japanese Nô drama robes give glowing evidence that man's need to beautify has persisted. Today, the artist still works to make the moments of our life more pleasurable: a Scandinavian chair, a Parisian gown, a New York stage set, Japanese packaging are the contemporary designer's contribution to the visual excitement and reward of our daily lives.

Mass production, made possible by the technological progress of our times, has been the cause of many of our societies' current problems. One of these problems is that of the badly-made object, mass-produced by insensitive or irresponsible persons, and forced upon an innocent public through the vicious misuse of advertising and other forms of propaganda, so that the public level of taste is consistently lowered until it actually selects the poorly constructed object in preference to the well designed one. The machine age has given us cities that look like prisons, highways and streets vulgarized by endless signs, billboards, neon lights.

But the machine in the hands of an artist can become a miraculous tool. The industrial designer, a product of

Venus du Mas, antique marble statue found in 1876 at Mas d'Agenais, south-western France.

© Giraudon, Paris

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Virgin and St. John, detail of The Crucifixion, painted by the 15th century German artist, Grunewald. Now in the Colmar Museum, France.

'Art is the conveyance of spirit by means of matter'

our modern world, has been working to make "good design" available to all men through mass produced furniture, textiles, utensils, buildings, automobiles, clothes, etc. There are many problems to be solved in this field, but we can look to the future with enthusiasm.

In consideration of art as enhancement we must come again to the question: What is beauty? We know that beauty is "relative"; for what may be deemed "beautiful" by one person, one culture, one age, may be considered "ugly" by another. But this is the very factor that makes the æsthetic object a human thing: it brings men together in agreement and at the same time separates them as individuals who see things in their own way. This is one of the major tasks of artists in society: to discover and establish new forms of beauty. When the day comes that all men are educated through art, as Herbert Read advises, they will learn to understand and respect the varying nature of beauty while at the same time maintaining a selective eye in their standards of æsthetic quality. And they will learn, as well, how æsthetic awareness can give new incentive, new enrichment to their lives.

Another factor to be considered when we look at the way in which art functions to enhance life is that which embraces the "pleasure principle." Running parallel to man's need for self-discipline, control, "denial," is the human need for fanciful escape, distraction, release from the self-inflicted tensions of civilized living.

We need only to look at the long and fascinating history of games, to find evidence of this fact. "Play" assumes an all important role in the world of the child; in the adult's life, the need for play persists, but the quality of play, the complexity of the games change and increase as the individual matures.

THE arts offer man an opportunity for play. Schiller has described this function of art in man's life in this way: "In the midst of the awful realm of powers, and of the sacred realm of laws, the æsthetic creative impulse is building unawares a third joyous realm of play and appearance, in which it releases mankind from all the shackles of circumstance and frees him from everything that may be called constraint; to grant freedom by means of freedom is the fundamental law of this kingdom."

There is an international relatedness, a coherence of things. The physical world, the universe, provide a highly structured and intricately formed environment for man. And man is a unit in the endlessly complex pattern; he is a form, within a form. Man's need for, search for relationship, order, springs from a primordial sense of consistency. This is the motive of inquiry, discovery, creativity; this is the basis for logic. But sometimes we see man, in his paradoxical attempt to destroy himself, deny and work against this innate sense of order. We find evidences of this contradiction in highly civilized societies where men inflict chaos upon themselves and then retreat in escape to overcrowded mental hospitals and psychiatrists' couches.

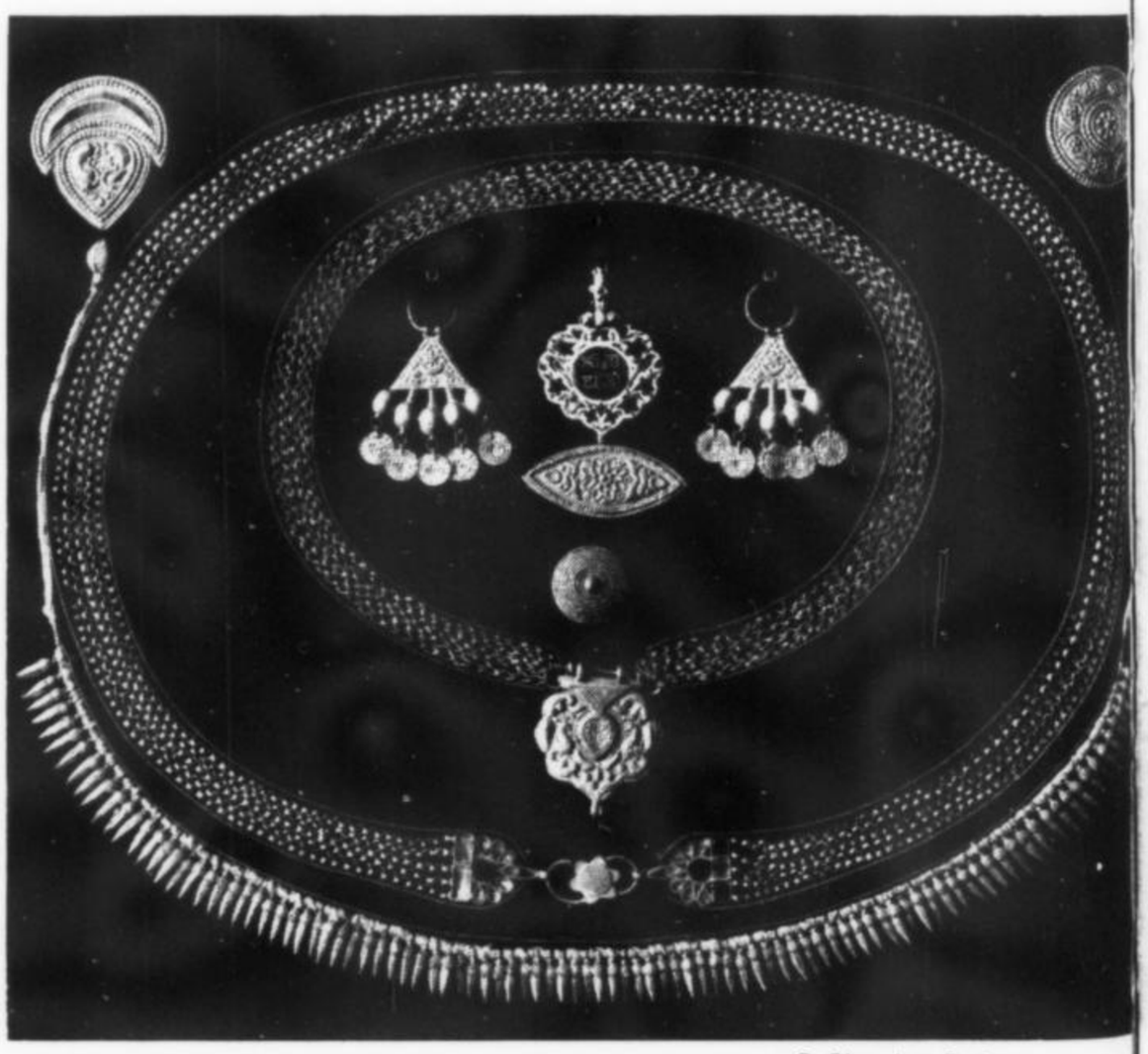
The superstructure of modern day man's institutional life is marked by a spreading disintegration. Specialization in occupations, compartmentalization in social activity separate human need from related human need and divorce human capacity from its use and fulfilment. The æsthetic experience enables man to bring the bits and particles of his life into an ordered structure, and it provides for the interaction of the human organism with environment.

Man, the artist, seeks to disentangle the most essential strands of existence and weave them into a beautiful fabric of intense validity, characteristic of himself and his culture and his time. The order and form we find in a work of art are not superimposed; they originate in the human act of creation and are an organic event.

Greek philosophy was deeply and inherently connected with Greek art, for it embodied not only rational thought, but also vision (theorica) which apprehends objects in relation to each other, and sees the idea in everything, namely visible pattern. Giotto, like his contemporary, Dante, saw life as a connection of parts. And later, Leonardo da Vinci sensed the same order in the universe and in the life of man. Paul Klee has commented that the artist is so well oriented he can put order into the flux of phenomena and experience. All men of art at all times are concerned with the total web of relationships among the parts of their existence.

Just as philosophy is characterized more by the formulation of its problems than by its solution of them (incomplete patterns possess their own inherent élan), and mathematics by a tendency toward completion, so the realm of art is a condition of this tendency toward completion, a search for order and harmony. Thus, when we speak of art as order, we really cannot narrow our thinking to some formula for peace and serenity that the realm of art offers man as a way of life.

The art experience, for child and man, is the manifestation of the human and universal search for order out of chaos; the work of art is the embodiment of this search. We can respect it and be grateful for it as such, in these times when the tendency toward order



© Giraudon, Paris

Gold necklaces and jewellery, India.

Salvador de Madariaga

and form is more and more frustrated and inhibited. Involvement in art gives incentive to our forming power and makes dynamic the order that we may find.

Our twentieth-century existence is marked by a growing disintegration: the child is separated from his parents, the parents are separated from each other, the family members are separated from the community, labour is separated from work and further separated into parts, each compartment is again separated, science is separated from art, philosophy from religion, and religion is splintered into opposing bits, formal education is separated into endless departments, the senses are separated from the intellect, and man is separated from man.

Man is, basically, filled with the urge to form, with the need to find harmony and build order. But it can happen that as societies and civilizations become more organized, more compartmentalized, more categorized, man becomes more confused, defeated, and dehumanized. For there can be order without integration; man can establish a system that puts the fragments of his existence into a rigid order. He can tightly regiment the moments of his life, thus making for himself an orderly plan by which to live. But the very neat and precise order he builds can become a series of separate prisons that divide and hold the many aspects of his being apart, and thus lead to his disintegration. Man not only needs to establish an orderly arrangement of the parts of his life, but he must integrate the parts into a meaningful whole, and the whole must become even more significant than the organization of the parts.

The synthesis of intellect and emotion is possible only on an aesthetic level of experience. Establishing relationships between the world of fantasy, imagination, thought, and the physical world of objective reality then is another of the functions of art. For, when the artist externalizes his visual image, he gives form to it and it

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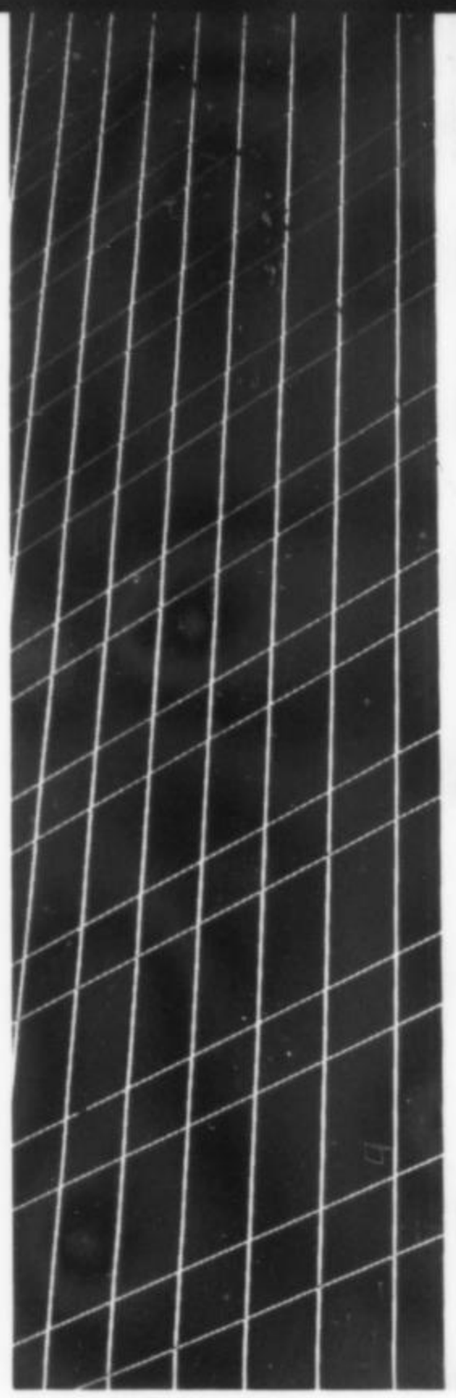
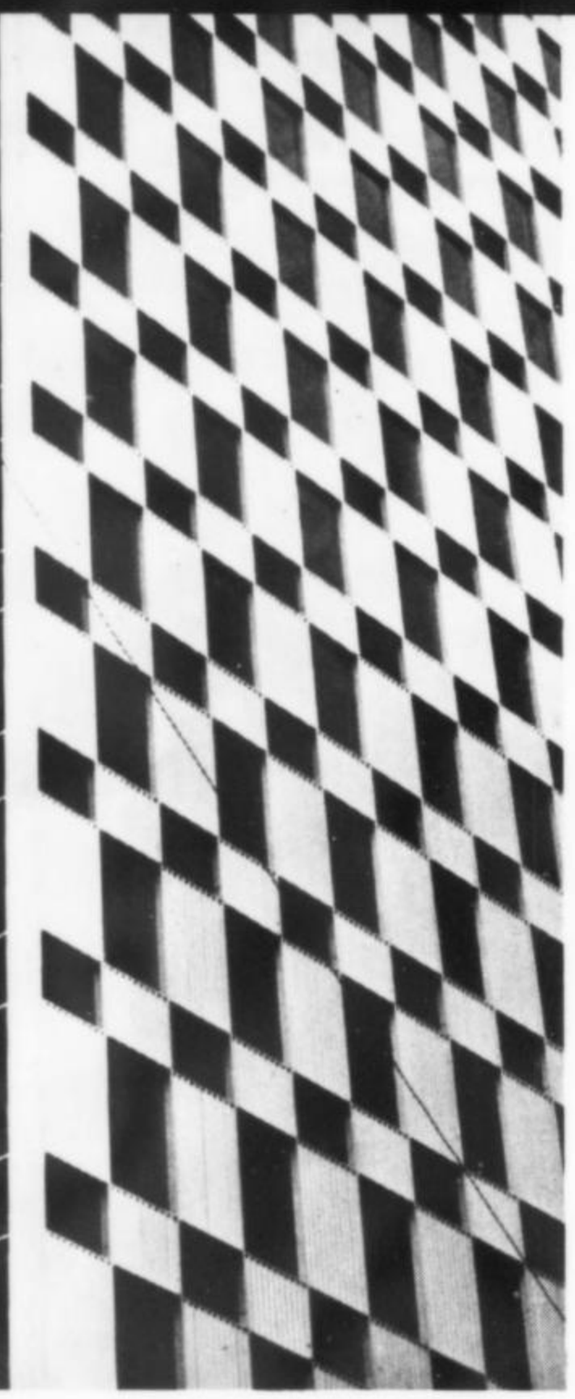
Decorative tassels made in France.

Traditional decorations of wooden dwellings in Batak village, Sumatra.

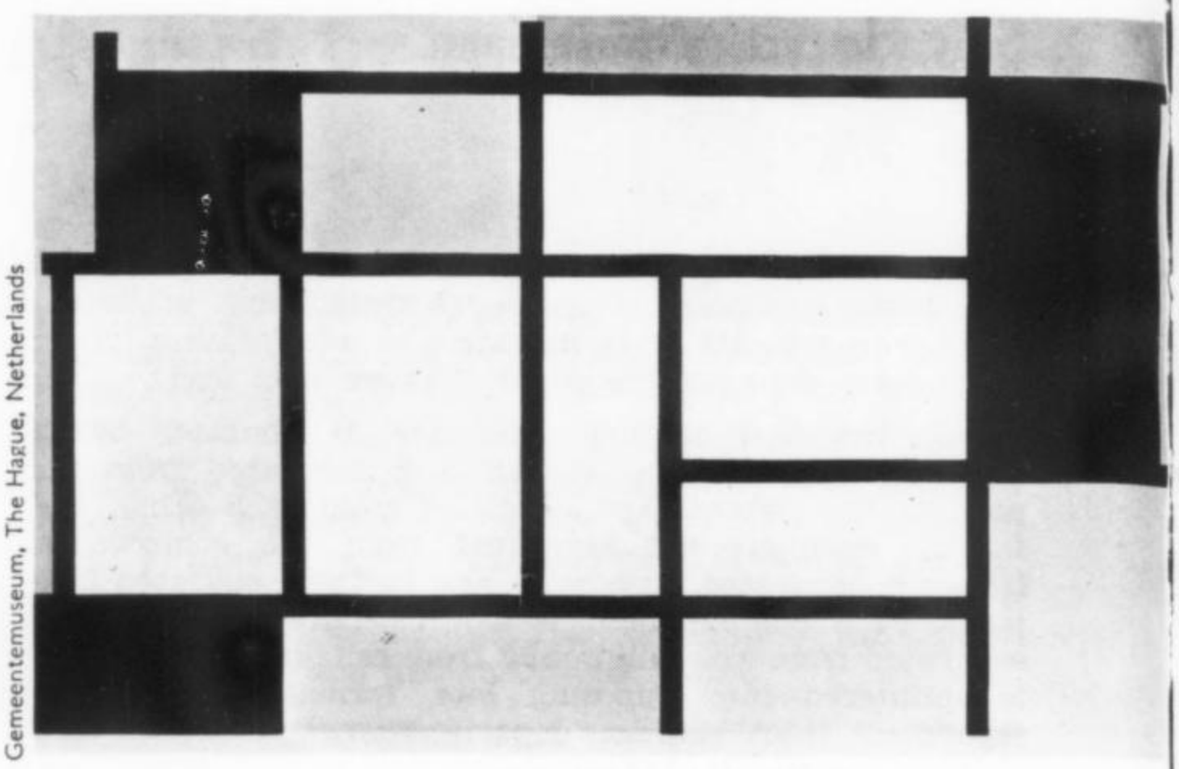
Unesco-Marc Riboud





Detail of exterior wall design of modern Mexican skyscraper.

© Paul Almasy



Gemeentemuseum, The Hague, Netherlands

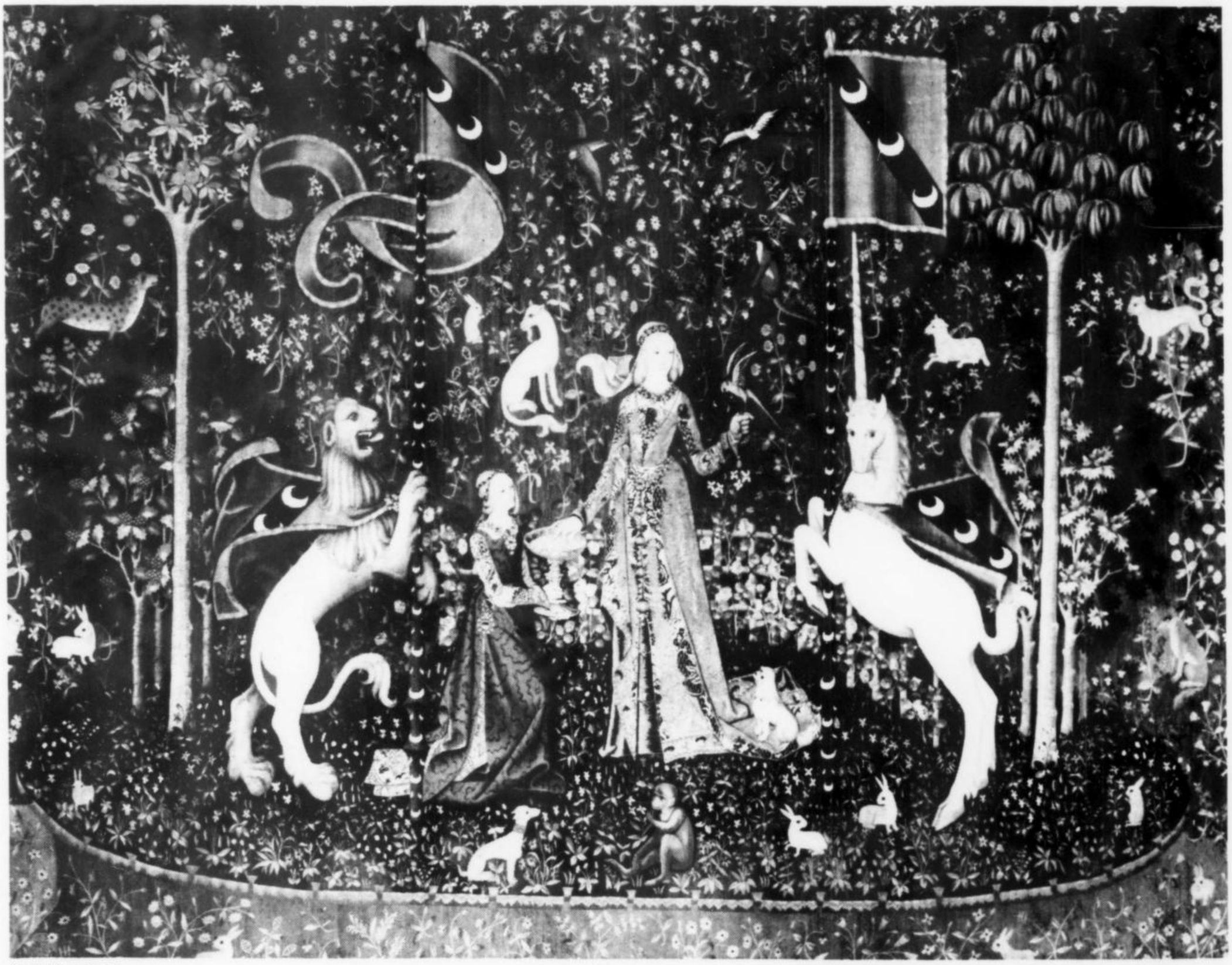
Composition in Red, Yellow and Blue, by Mondrian.

© Paul Almasy

Traditional decorative designs, Ndebele tribe, South Africa.

'Great art is an instant in eternity'

James Huneker



© Bulloz, Paris

Supreme poetic masterpiece of Gothic art, the six tapestries known as "La Dame à la Licorne" (The Lady with the Unicorn) are supposed to have been made for an early 15th century French nobleman as a gift for his bride-to-be. Five of them represent the Allegories of the Five Senses while the sixth shows the Lady under a canopy. Above, a detail from the Allegory of the Sense of Taste. The Lady is seen taking a sweet from a bowl proffered by her attendant. The exquisitely woven animals and flowers are set against a red ground and a blue carpet. The mythical unicorn symbolizes purity and stability. Cluny Museum, Paris.

becomes a fact. The great artist is one who has successfully integrated vast areas of human experience.

The problem of the integration of man, of society, is one that has long concerned philosophers, psychologists, educators, and all who study human need and behaviour. Eastern cultures have given emphasis to this problem of man's oneness, selfhood, union. Zen Buddhism, which is a culmination of several ancient Indian, Chinese, and Japanese philosophies, attempts to liberate the energies stored in each man, which are, in ordinary circumstances, cramped and distorted so that they find no adequate channel for activity; Zen develops the art of seeing into the nature of one's own being.

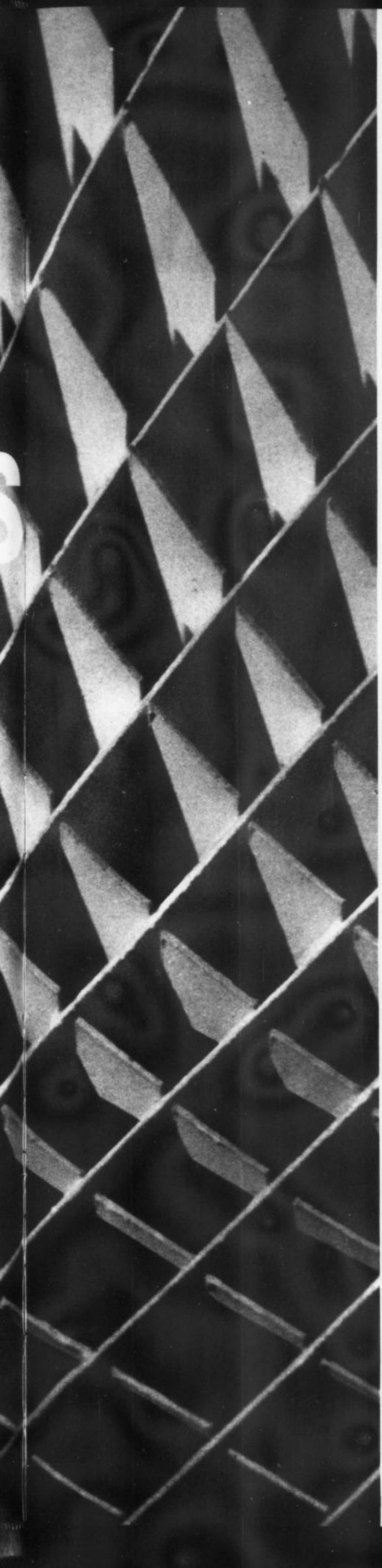
Zen Buddhists have long known and respected the power of art as integration; they know that when a man is intensely involved in his craft, he is at one with it, and thus he is at one with nature and with himself. The form of painting practised in Zen is known as Sumiye; it attempts to catch the Spirit as it moves; everything becomes, nothing is stationary; the artist must follow his inspiration as spontaneously and absolutely and instantly as it moves. Sumiye painting, like much of the abstract painting of contemporary occidental cultures, calls upon the whole man at once; his physical, his emotional his intellectual, his spiritual selves are integrated into one act, one moment, one man.

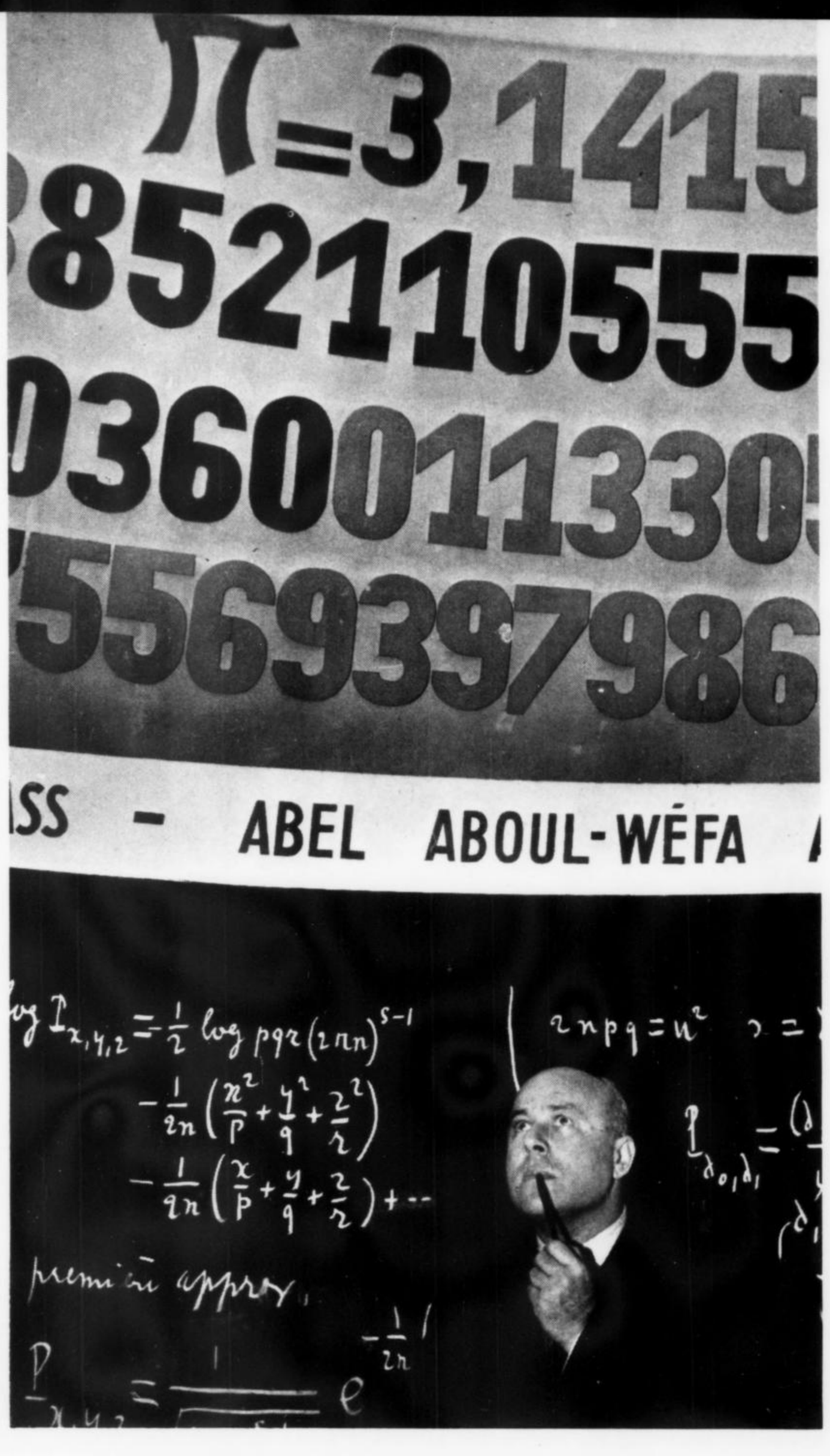
Today the entire society of man, threatened with spiritual and physical disintegration is becoming aware of its own separateness, emptiness, purposelessness. We are a human race in search of meaning, in need of form to shape the welter of incoherent fragments that enter our experience. Only when art has reintegrated, rehumanized society will the human race be ready, in Goethe's words, to live manfully in the whole, the good, and the beautiful. If we are to find new motivation, new direction, new harmony for our life, we must turn to art, for the plan and model is there.

Dr. d'Arcy Hayman, who directs the Programme in Art Education for UNESCO, *has been a member of the Faculties of Art and Art Education at the University of California, New York University and Columbia University. She is an American educator, author, and painter.*

ART IN MATHEMATICS

Above, honeycomb of curves constructed according to Gauss law on "the distribution of a two dimensional random variable." Opposite page, figure-filled wall in the Mathematics Hall of the Palace of Discovery in Paris.





Photos (©) Paul Almasy

SPIRALS in space, graceful whorls rising in the monumental architecture of our time, billowing honeycombs and cubist dreams are all on exhibition in a museum which, even though it is located in Paris, has nothing to do with art.

The museum is the *Palais de la Découverte* just off the Champs-Elysées and its "sculptures", easily the rival of avant-garde art, are nothing but mathematical forms projected in three dimensions.

A walk through the Mathematics Hall of this "Palace of Discovery" is quite an experience for the layman. Accustomed to abstract art, he experiences the shock of

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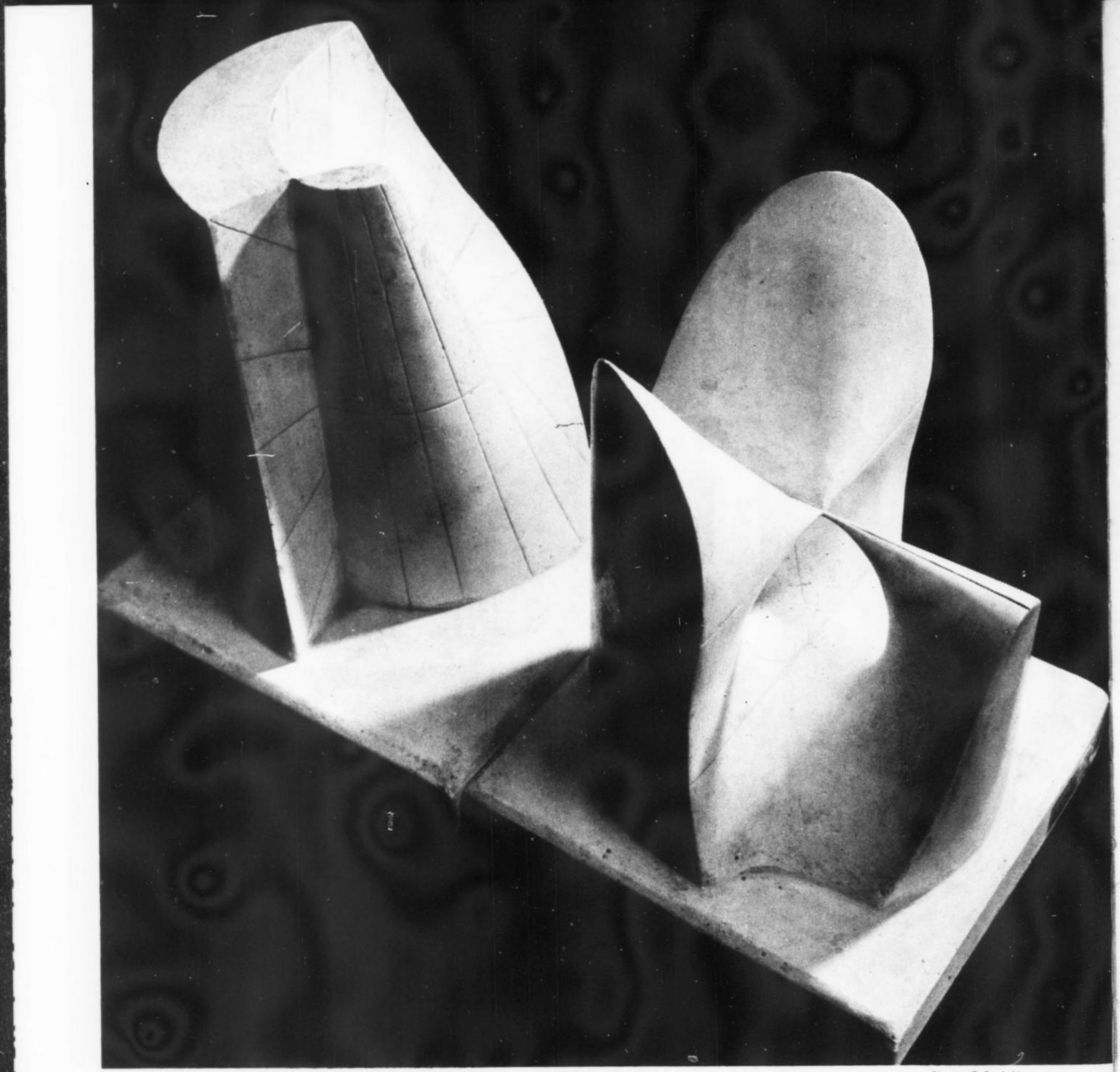

Apparently works of abstract sculpture, these forms present two of the infinitely many possible shapes representing third degree equations.

Photos © Paul Almasy

encountering its forms as expressions of the basic reality of mathematics.

The result is a head-spinning world in which lines intersect harmoniously, mountains rise out of a lunar surface and curves seem to have been moulded by the loving thumb of the sculptor shaping clay to conform to an image in his mind. It is a gallery of forms, some beautiful, some perhaps nightmarish, but all with an emotional content for the spectator.

The most amazing aspect of these "works of art" is that they could have been produced by a robot—an electronic computer capable of plotting equations in space.

Their beauty lies in their abstract mathematical orderliness, the very effect to which so many modern artists strive in non-figurative works.

Obviously, this is not art for art's sake and the layman is somewhat of an intruder in the Mathematics Hall. The *Palais de la Découverte* is a science museum widely used by students in Paris and its "sculpture" illustrates basic mathematical formulae.

Take, for example, the case of a honeycomb structure whose jutting prow might well be the façade of some experimental housing project. The honeycomb is composed of curves constructed according to Gauss' law, which lays down the so-called normal distribution encountered in many problems of probability and statistics. A dancing spiral of wire is, in mathematical terms, "a canal surface generated by moving a sphere of constant

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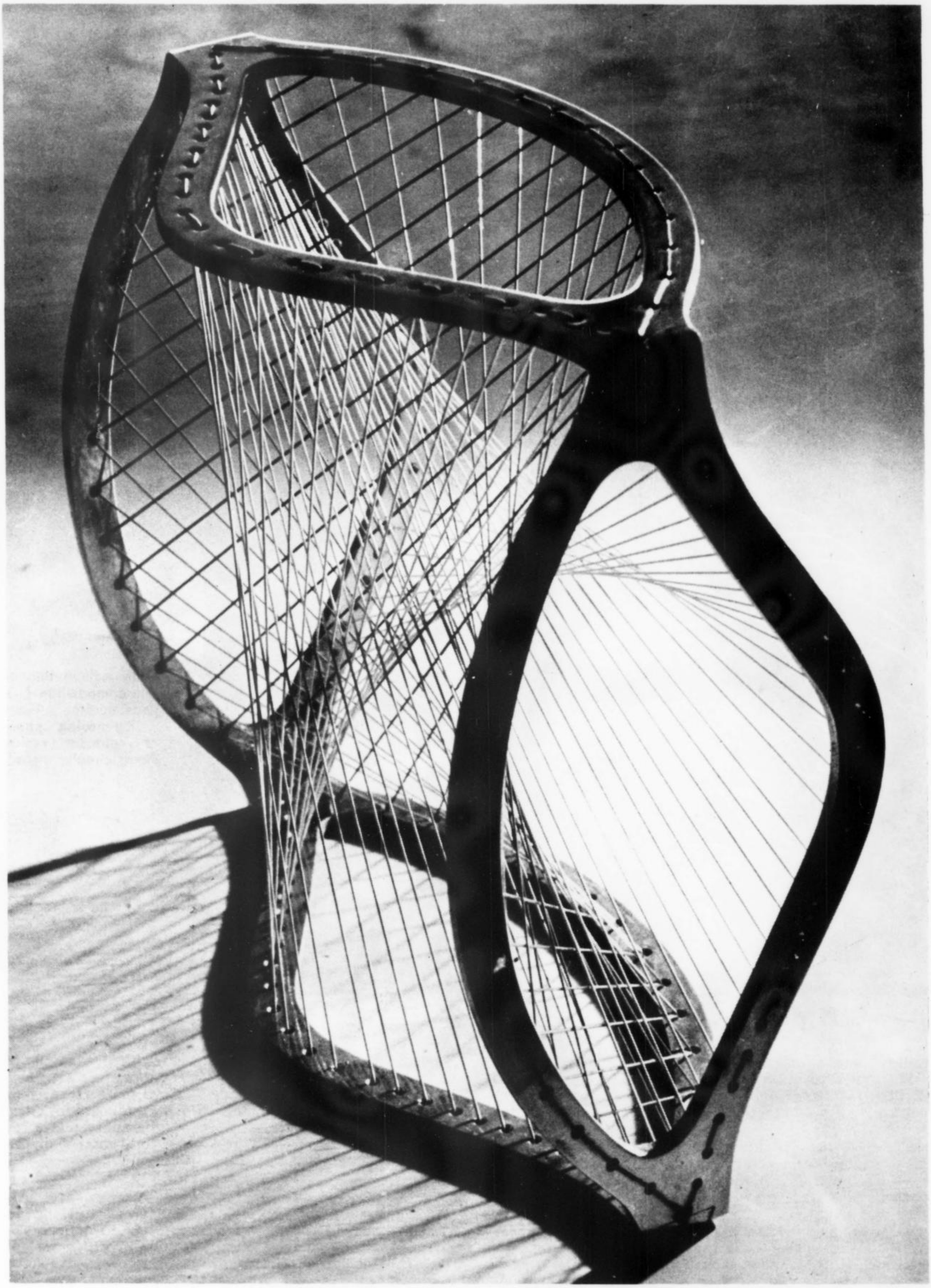

Moving straight lines in space can generate curved surfaces of unusual beauty. One of these surfaces is Plücker's conoid (above), named after one of the inventors of projective geometry.

ART IN MATHEMATICS
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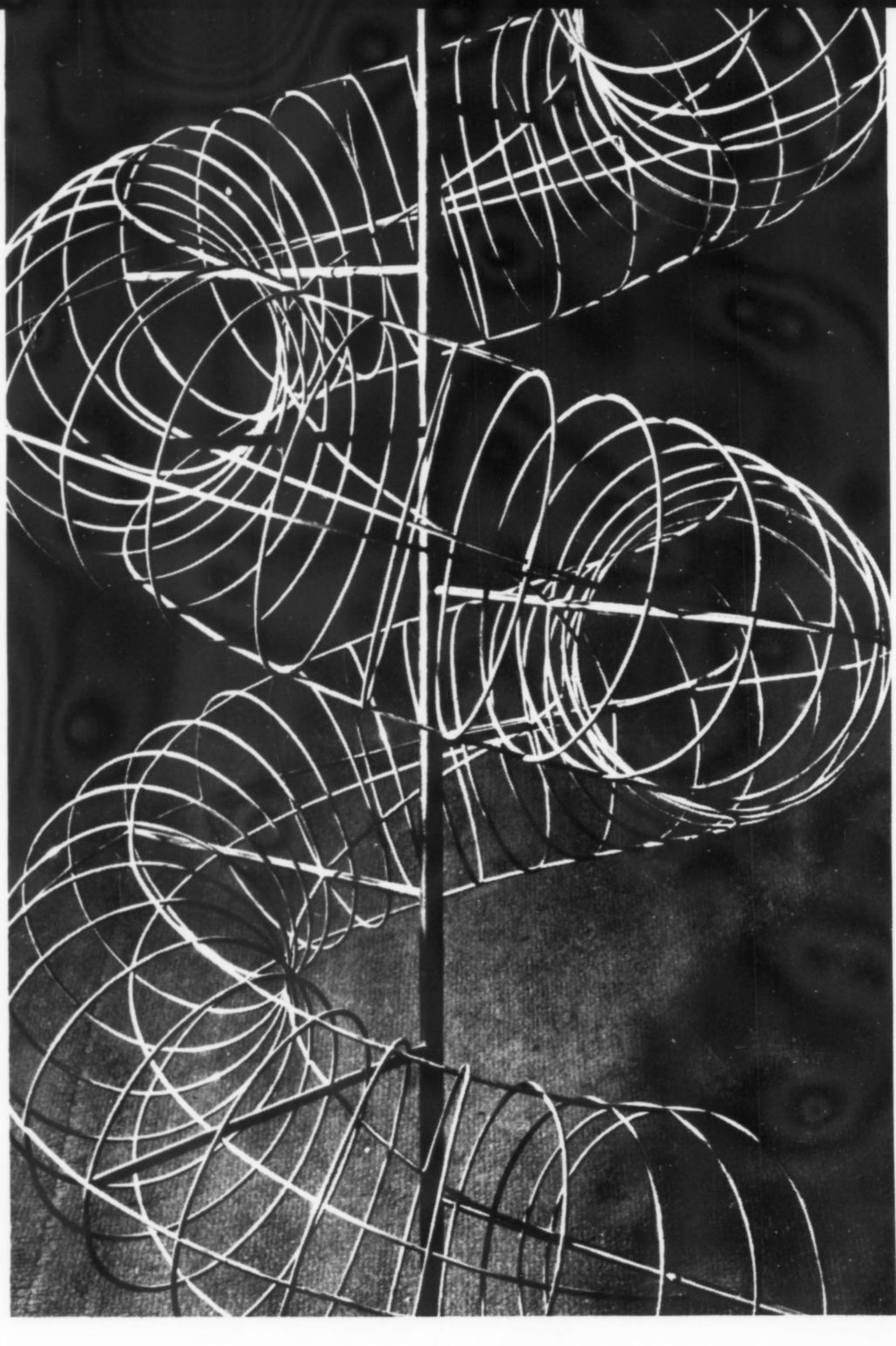


Mathematical title of this composition : "a canal surface generated by moving sphere of constant radius along circular helix".

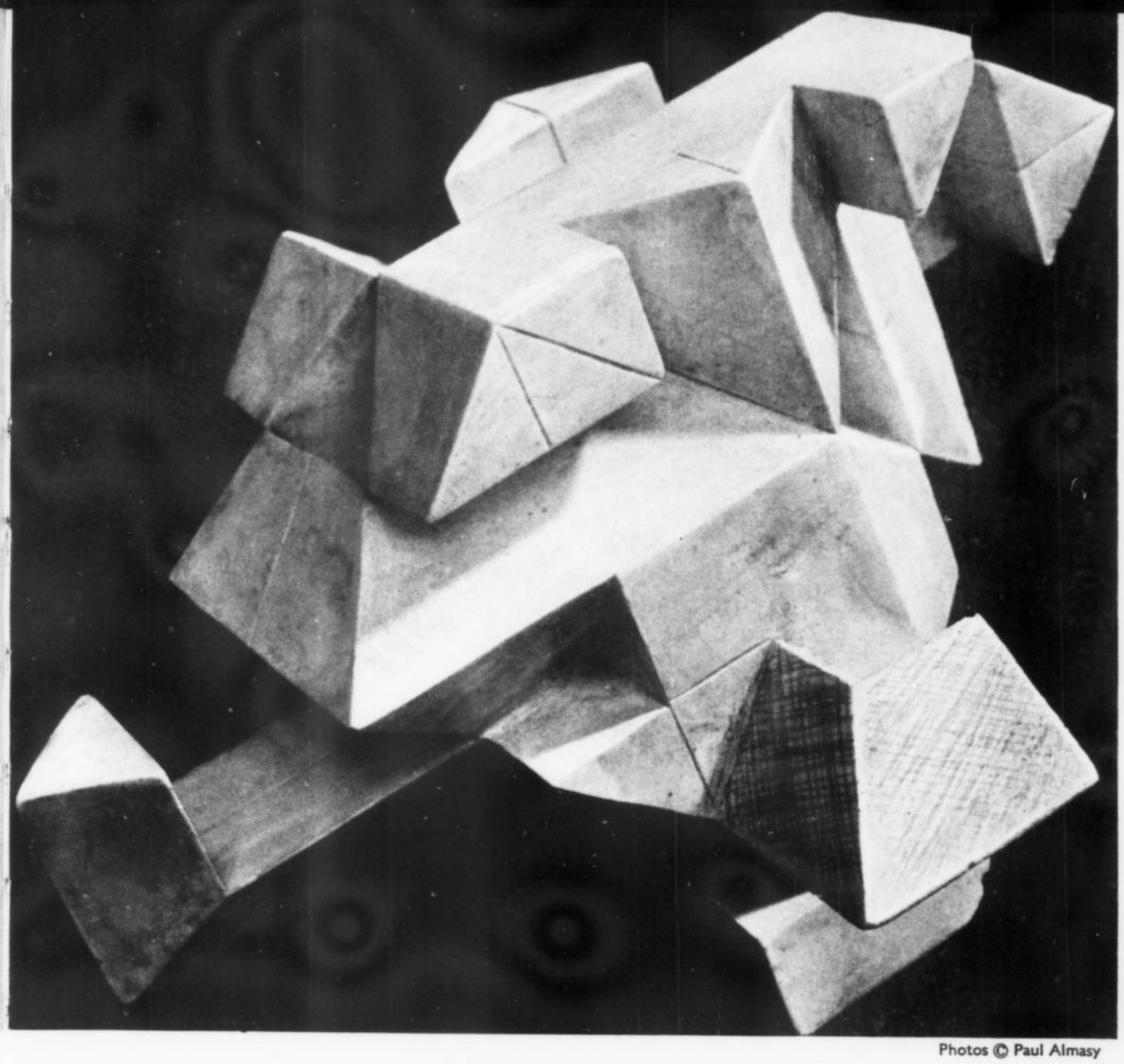
radius along a circular helix"... which is one way of saying "winding a length of wire around a circular rod." An abstract basket is Plücker's conoid, produced by moving straight lines through space in differential geometry.

Models of these equations have been known to mathematicians for three centuries, but they usually remained on their desks as esoteric objects reserved for the initiated.

In 1937, the *Palais de la Découverte* introduced them to the Paris public and this mathematical art show has been a steady success ever since, both for budding mathematicians and visitors who happen to encounter a strange world created by man's genius —a world in which poetry and harmony are produced by nothing more than equations.

This sculpture-by-formulae is a classical example of how science and aesthetics can meet to produce art. This same meeting has been brought about more recently in such fields as microphotography, crystallography, the study of cosmic ray images on photographic plates, or even in nuclear physics (the architectural symbol of the Brussels World Fair was a gigantic atom).

And, paradoxically enough, while scientists are producing art, many present-day artists are turning to science and technology in their efforts to reflect the reality of this new and unexplored era in which we are living. One can only conclude that the so-called divorce between science and art—between the humanities and technology, if you prefer—is not as irrevocable as it may first appear.



Two mathematical models shown here illustrate (left) solids which permit an equipartition of space and (below) a third degree surface on which 27 "real" straight lines are possible.

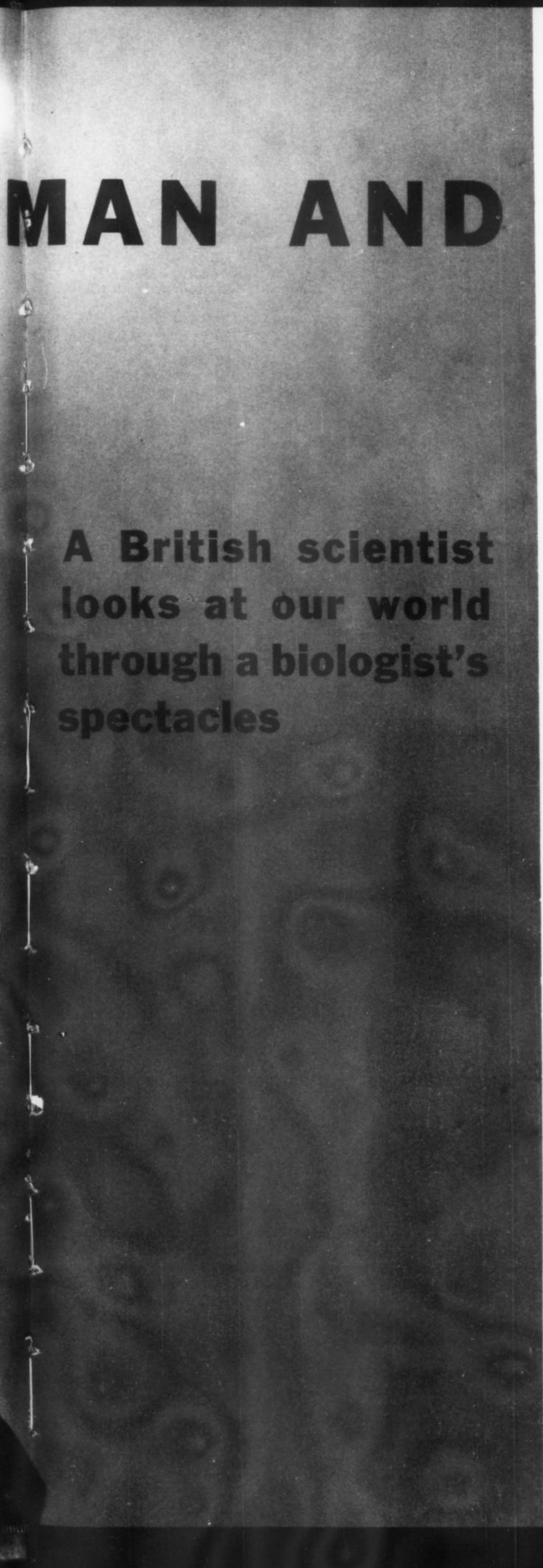
Photos © Paul Almasy

SCIENCE, M

Scientists take advantage of every important eclipse to make solar studies with specialized instruments and thus discover more about the nature and activity of our giant, life-giving sun. Photo shows an eclipse being recorded at Kuwait.

George Rodger © Magnum Photos, Paris

MAN AND SOCIETY



A British scientist looks at our world through a biologist's spectacles

By Sir James Gray, F.R.S.

Former President of the British Association
for the Advancement of Science

One of the most important aspects of modern science is its repercussion on international relationships, and when it begins to threaten the existence of the whole human race, it really does seem to be going just a step too far. There will always be danger and appalling waste of human effort until individual nations can be persuaded, or are forced, to think in terms of the welfare of humanity as a whole. It is not our job to suggest how this might best be achieved by moral or political agreement. A scientific approach must be completely dispassionate, but we shall not make much impression on public opinion so long as men's minds are biased by fear and suspicion. Frightened or angry politicians, like frightened or angry animals, cannot be trusted to react wisely.

There is not the slightest doubt, however, that the discoveries of physics *have* frightened mankind and that there are far too many intelligent people looking askance at Science and wondering where it is leading them. In trying to link Science to the humanities our primary objective should be to depict Man's position in the world of Nature as a source—not of fear or doubt, but of courage and inspiration.

Our second main objective should be to demonstrate the place of Science in a general philosophy of life. To be of real value, such a philosophy must rest on knowledge and experience which has already proved acceptable over a very wide range of local environments and national interests, and it must, at the same time, be closely concerned with problems of everyday life. In these respects Science is unique.

Except when subjected to political restraint, scientists of all nations have always co-operated in solving Nature's jig-saws, and as Professor A.V. Hill has said, "The fundamental principle of scientific work is the unbending integrity of thought, following the evidence of fact wherever it may lead within the limits of experimental error and honest mistake."

This attitude of mind is not peculiar to scientists; it is common to all who have a respect for the truth. But in the fields of law, language, history, literature and, above all, politics, our general outlook and our individual range of knowledge depend to a very dangerous extent on local environment and national tradition. By freedom from such limitations Science provides ground—perhaps the most solid ground—for wider co-operation.

But the gap between a scientific and a humanitarian outlook cannot be bridged by the statistical laws of physics and chemistry; we are forced to apply less precise, but not necessarily less important principles from the world of living organisms. The challenge is, therefore, to the biological sciences, especially those which deal, at

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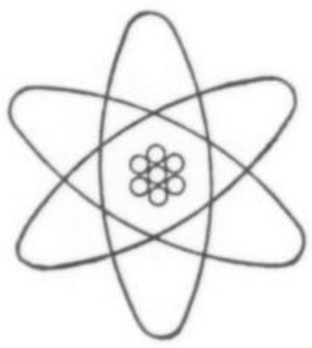
THE PROPER STUDY

the borderline of sociology, with the behaviour of organisms and their relationship to their environment. The extent to which they can yield broad principles applicable to Man may well decide how far Science can claim to be of direct cultural significance.

Man's position in the world of Nature is brought most sharply into focus by the concept of natural evolution. Cosmic, biological and human evolution can be regarded as phases in a continuous natural process—and, from this point of view, astronomy, geology, biology, archaeology *and* history form a continuous spectrum of knowledge. To pass through many millions of years from a primaeval nebula to modern man without any sudden break in continuity of thought gives a feeling of intellectual tidiness, but quite apart from this it enables us to visualize Man against the background of his past and to regard him as Nature's supreme masterpiece. At the same time, he must not get *too* big for his biological boots or tend to exaggerate the gap between himself and the rest of the animal kingdom.



No animal can manufacture aeroplanes, or Asdic; but the prize for aeronautics must go to the shearwater which navigated the Atlantic without compass or chart, that for Asdic to the ears and vocal cords of our nearer relatives, the bats. By surrounding themselves with an electric field, some fish (e.g. *Gymnarchus*) can, in total darkness, detect foreign objects in the surrounding water with very remarkable precision.

The total weight of the mechanism involved—including the animal's brain—amounts only to a few grammes; a man-made instrument of comparable performance would involve at least a ton of highly complex electronic machinery. Again, there is no laboratory in the world which can compete with the biochemical skill of even the smallest living organism.

In fact, as delicate and precise pieces of machinery, Man's inventions so far compare very unfavourably with those which have come into existence during the natural course of biological evolution. On the other hand, we may fairly claim that we have accomplished in a few centuries things for which Nature required many millions of years. Nevertheless, we need not be in the least ashamed of the older members of our evolutionary family; we have still a great deal to learn from them.

To visualize Man's position in the animal world, it may be useful to define his main diagnostic characters. He is a highly gregarious bipedal mammal with unspecialized limbs but a *very* large brain. He is the only animal which has developed the symbolisms of speech and writing, and he may well be the only animal capable of rational thought. He is, therefore, the only organism which can hand on patterns of acquired learning from one generation to another. To these advantages he owes his dominant position in the world today.

They have enabled him to exploit his environment and increase his numbers and his range of distribution far more quickly and far more extensively than any animal of comparable size. He has eliminated some of his competitors and exploited others for his own use, but the time has now come when different races of men are competing with each other within the closed arena of a limited environment, and it is not easy to see where it will end.

There is nothing equivalent to this in the inanimate world; but, when a biologist looks at the general trend of events, he is inclined to say, "Where have I seen something like this before, what is it due to, and how does it *usually* end?"

Nature has made, not one, but two *great* experiments in the design of social animals. The first was carried out in Mesozoic times when Man's mammalian ancestors were beginning to emerge from reptiles. The results of this experiment are represented today by the social insects—notably the ants.

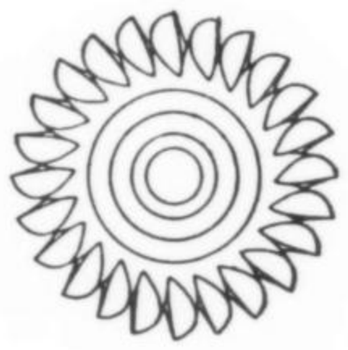
There are a very large number of different species of ants, none of which interbreed; among them is found a range of complexity of social behaviour which is not only unique in the animal kingdom but which forms a very remarkable parallel to different races of human beings.

At one extreme are species forming small communities, restricted to localized or specialized environments and exhibiting relatively little subdivision of labour between individuals.

At the other extreme are large and often aggressive communities with marked differentiation of structure between different grades of individuals; populations of this type display high levels of co-operative effort involving, in some cases, the rudiments of agriculture and husbandry. In all cases, however, ant societies are organized on a straightforward totalitarian basis, the contribution made by each individual towards the welfare of the community is determined from the time of birth; each grade of individual is structurally adapted for predetermined tasks.

How far ants can communicate with each other may be doubtful, but it is tolerably certain that members of the same community recognize each other by a characteristic smell, and as the brain of an ant is about the size of the head of a pin, it is perhaps not surprising that ants should attack or kill an individual from another colony with a smell slightly different to their own. It is much less easy to understand why a man, with a brain of an entirely different order of complexity, should, at times, react almost equally violently to skin pigments different to his own.

But it is not only in respect to individual relationships that the study of ants is relevant to Man. Ants are the only organisms which—apart from Man—indulge in organized warfare—raiding the nests of other species and incorporating captives into their own societies. But perhaps the most striking facts relate to species which have changed their habits and distribution within recent times.



Two instances of territorial expansion are known to have occurred in the last 150 years. Early in the nineteenth century an Eastern species (*Pheidola megacephala*), having spread rapidly over North Africa and South Europe, managed to reach the islands of Madeira and Bermuda; in both places it exterminated the smaller native races.

Meanwhile, a similar policy had been carried out by another species (*Iridomyrmex humilis*), from the Argentine, which, having landed at New Orleans, very rapidly overran the southern United States; in due course, it

OF MANKIND IS MAN

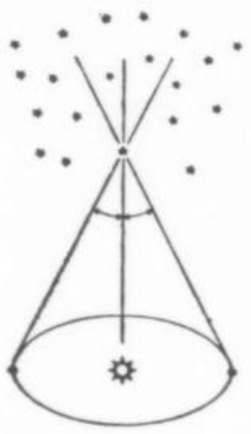
too reached Bermuda, where it proceeded to eliminate the earlier invader.

In the world of ants there is no place for small peaceful communities unless they can isolate themselves effectively from larger and more powerful neighbours, nor does there seem any lasting peace between large aggressive communities. Solomon's advice has, I suspect, been misinterpreted. It should read: "Consider the ants, and, if you use your intelligence, you will see how *not* to deal with international problems."

Having designed the ants, Nature waited for about 150 million years before embarking on her second or human experiment. She waited, in fact, until it could be carried out with a species in which an individual's contribution to society was no longer based on inherited structural characters but on the power of inter-communication with other individuals; in other words, until Man's brain had reached a level of development which enabled him to control his environment, and to deal rationally with the subdivision of labour between individuals and with the distribution of natural resources between different groups of individuals.

At the same time she arranged that such groups should not be physiologically isolated from each other. Different races of men can interbreed, or they can, if they wish, come to mutual agreement about the distribution of world resources. The first policy would seem to lead to a world state with uniformity of social pattern and of material interests; the second involves territorial limitations and economic agreements. Both, as we know only too well, involve great practical difficulties. All the same, men ought to be able to do something better than ants.

The second basis of comparison between Man and animals concerns the factors which control his behaviour. The past 50 years have produced a very great increase in our knowledge of animal behaviour. For present purposes, however, attention may be focused on two problems: the extent to which animals can profit from extraneous instruction, and the extent to which they are able to learn for themselves.



We can explore the first of these fields by means of the conditioned-reflex technique, whereby an animal learns to associate a specific visual, or other sensory stimulus with forthcoming food or impending danger. In order to establish this result it is necessary to conform with five basic principles all of which have their counterpart in the training of human beings.

(1) The response expected from the animal must not be unduly complex; the animal must be able to reach the food or escape the danger by making reasonably simple movements. In other words, the problem must not be too difficult.

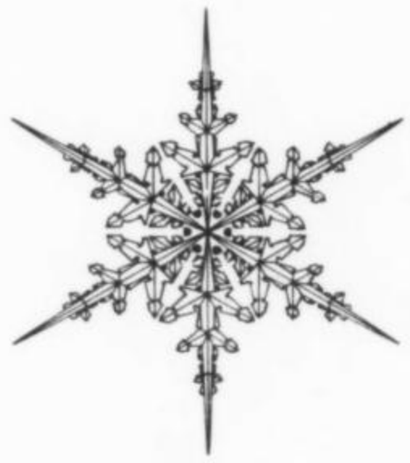
(2) The lesson must be presented to the animal under conditions which ensure freedom from extraneous disturbance. It will not learn if its attention is constantly diverted by other changes in its environment.

(3) The problem must be presented to the animal on an adequate number of occasions; the more frequent the lesson, the fewer the mistakes become.

(4) There must be an "incentive" to learn—a reward for success or a punishment for failure. Further, the "reward" must be related to the needs of the animal.

(5) Finally, the experimenter must possess adequate skill and patience. The ability of an animal to learn depends to a very large extent on the personality and enthusiasm of the teacher.

These five principles apply equally well to the education of human beings if we make suitable allowances for increase in complexity of the lesson and for changes in the nature of the incentive to learn. But we can go a little further, for, as with men, different individuals of the same animal species learn at very different rates. Curiously enough, however, there does not seem to be any clear correlation between an animal's ability to learn and its position on the evolutionary tree.



It is possible to trace the structural evolution of the human brain through each of the main classes of vertebrate animals; the large paired hemispheres of our brain arose in the Devonian lung-fishes and the cerebral cortex in the early Permian reptiles.

It would be very convenient if step by step with an increase in size and complexity of the brain it were possible to trace a corresponding increase in complexity of behaviour and in ability to learn. This is not the case; some fish without hemispheres or cortex can exhibit behaviour patterns which seem just as complex as those of reptiles or even of some mammals.

In due course this difficulty will be resolved, but for the time being one can only say that there seems to be one feature common to all species which learn easily, namely, a vivacious but not unduly excitable temperament—fish, rats, monkeys and children all have a natural tendency to explore their environment and they are interested in anything new or strange; they are all, perhaps, potentially good scientific observers.

But the value of the instruction given to human beings by a teacher is largely judged by the extent to which it enables a pupil to make use of his acquired knowledge and to go on to learn more by himself. Within the animal world there is very little evidence to suggest that experience acquired from one pattern of environment or from one problem can be readily applied to others of a somewhat different nature. An animal's own approach to a problem, like that of a very young child, is very largely one of random exploration; once it has found the solution by chance, the number of ineffective responses on future occasions becomes less and less until the correct response is stabilized.

How far animals display evidence of the higher levels of mental analysis associated with "intelligence" in human beings is not too clear, for it is extremely difficult to subject intelligence to an agreed standard of measurement. When judged by human standards the I.Q.s. of all animals are, undoubtedly, very low; but, it may be that we are not always setting *them* quite the right type of examination.

Although it is difficult to correlate an increasing capacity to learn with an increase in size and complexity of the brain throughout the main classes of vertebrates, it seems clear that there is a substantial increase in

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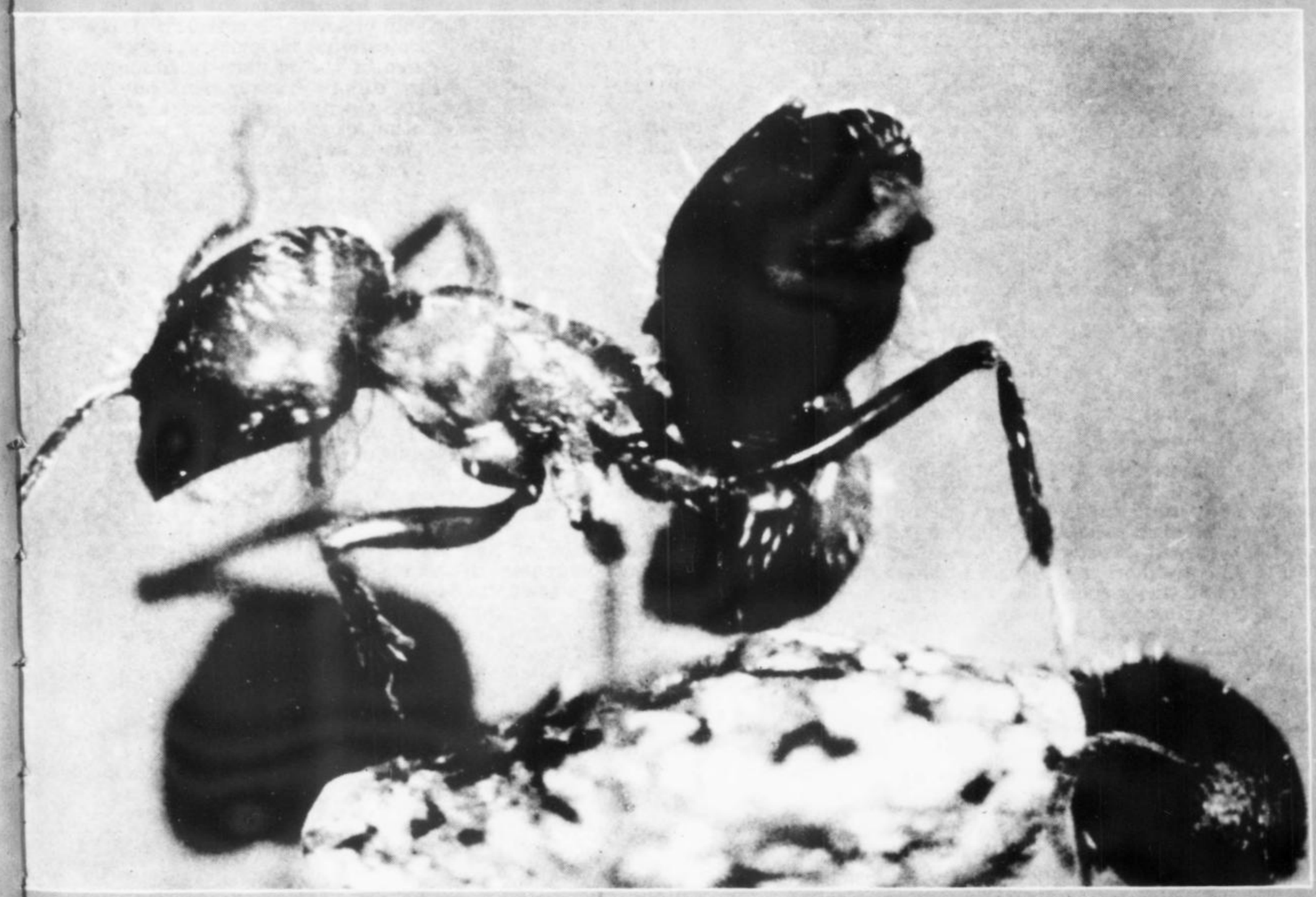
ARE MEN NO BETTER THAN ANTS?

WAR IN THE ANT WORLD. In the world of ants there is no place for small peaceful communities unless they can isolate themselves from larger and more powerful neighbours, nor does there seem any lasting peace between large aggressive communities. Warfare in the world of ants is graphically shown in these photos taken from a new Walt Disney film, "Secrets of Life." Left, a black ant overcomes an opposing red ant by crushing him against the roof of his underground tunnel. Above, pitched battle between red and black ants. The fight for survival in Nature's teeming world of insects becomes open warfare, even between families of the same species, and the battles that rage between the red ants and black ants are among the deadliest. Below, the headhunter—a red ant returning with four heads, his own and those of three rival black ants who lost theirs in battle.
Photos taken from "Secrets of Life" © Walt Disney



MAN VIEWED THROUGH BIOLOGICAL SPECTACLES

learning ability as soon as an animal's brain reaches a level of structural complexity comparable with that of man.

The young chimpanzee, like a human baby, is typically a friendly, playful creature dependent on and with an affection for its mother. But as it grows up, it begins to show marked signs of individuality; some become morose, unfriendly and vicious, others retain a friendly disposition towards their neighbours and a co-operative attitude towards human teachers.

The ability to respond to training shown by the latter type of individual is, of course, very remarkable, but when left to itself a chimpanzee seems to rely on an initial process of trial and error. Like many other mammals, it can give audible and visible signs of fear, anger or pain; but there is no evidence that a chimpanzee can make audible or visible signs which other individuals associate with specific material objects; the mental development of the adult ape seems roughly equivalent to that of a human baby before the latter has learnt to speak.

In short, nothing can possibly disguise the enormous difference between an adult ape and an adult man in ability to learn and to control their environments, but it might be argued that a relative test of the brains of the ape and of Man as computing instruments should be conducted on the basis that neither pupil nor teacher should be allowed to speak, read or write: the gap between animals and men might narrow very appreciably.

The third and perhaps most important biological aspect of Man's behaviour concerns the gregarious habit. Here again the distribution among vertebrate animals is curiously unrelated to their evolutionary history: it is well marked in certain species of fish, birds and mammals but absent in others. In some cases the existence of a herd or flock is clearly of survival value; a pack of wolves has a wider choice of food than an individual operating by itself.

But it is not always clear why one species should be more gregarious than another to which it is closely related. In the present state of knowledge it may be safer to say that some animals are restless or uneasy unless in close proximity to individuals of the same species—that they have, in fact, a deep-rooted antipathy to isolation or loneliness. In any event the resultant grouping establishes the herd as a unit which responds as a whole to an external stimulus applied to one or a few individuals.

The response is most clearly marked when the stimulus evokes an emotional reaction of fear or anger in the individuals directly concerned, and one of the most distinctive features of herd behaviour is the speed at which these emotions spread throughout the community. If certain individuals are more highly susceptible than others to external stimuli the response of the group is determined by the most timorous or the most belligerent members of the community.

The majority of the herd subjugate their own individual behaviour to that of a few, and in the long run the individual benefits by greater security from predators or greater certainty of obtaining food. If an individual is unduly insensitive to emotional stimulation by its neighbours, it is likely to be eliminated by natural selection—the sheep that walks by itself gets eaten and the solitary wolf may starve.

These principles were applied to the analysis of human behaviour by Wilfred Trotter (described in his book, "*The Herd Instinct in Peace and War*"). In order to avoid physical or mental isolation men are prepared to subjugate their own immediate needs or predilections to those of society as a whole. Antisocial activity is kept in check by fear of intellectual or physical isolation; feelings of increased security and greater freedom from personal doubts and fears are set off against loss of individual freedom of action.

How far psychologists have developed or rejected Trotter's suggestions I do not know, but there can be little doubt that they opened up a useful biological approach to sociology by suggesting that our instinctive reaction to something new or strange is, as in animals, to conform with our neighbours, and that, at moments of crisis, it is better to follow a leader than rely on personal judgments. These and allied problems belong to the domain of psychology. All I wish to stress is that the phenomena of mass psychology in Man, like other aspects of his behaviour, have their roots far down in his evolutionary history.

Perhaps the most striking difference between the social habits of Man and those of animals is the existence of a hierarchy or grading within human society. Only in a very few cases does this appear to exist within the animal kingdom. The nearest approach seems to occur in birds; a flock of jackdaws feeding in a restricted area resolves itself into a well-marked order of feeding priority. Konrad Lorentz has recently reported that if a high-ranking male decides to mate with a low-ranking female, the latter rises in social status and feeds with her husband; all this sounds reasonably familiar to human ears.

This is perhaps as far as a zoologist ought to go in trying to view mankind through biological spectacles. But one does not need to be a professional biologist to appreciate that the rates of change in the pattern of human behaviour and in the nature of our environment have, during the past five thousand years, been incomparably greater than those of any other organism at any period of its history; our clothes, houses, habits and social organization change with successive generations.

The fact is that if one were forced to choose the organism which best displays the phenomenon of persistent evolutionary change one would undoubtedly choose Man.

In suggesting further points at which biological principles seem to be applicable to the evolution of human society, a zoologist can only look towards Archaelogy and Anthropology and hope that his spectacles are not completely out of focus. In its very early stages human society must have been organized into quite small units, each dependent on the natural resources of a small circumscribed environment.

The discovery of fire and development of agriculture must have increased the range of the environment and the optimum size of the population required for its exploitation, and the stability of the group would become more and more dependent on the maintenance of an effective subdivision of labour; but the larger the population and the greater the degree of specialization, the greater the limitations imposed on individual freedom of action.

A new and very important social factor seems to have come into action when natural phenomena became linked with supernatural concepts—fear of isolation or reprisals from fellow-men being reinforced by fear of a superhuman agency and a sense of greater security inspired by reliance on supernatural support. Such beliefs had no material basis but they would be the cement which held society together and, as such, be of immense survival

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Although the difference in ability to learn between man and ape is enormous, scientists are now not too sure to what point animals can actually carry out high-level mental analyses associated with "intelligence." In I.Q. tests animals usually rate very low, but many scientists believe that present methods of testing may be wrong. Photo shows research worker studying the reactions of a chimpanzee to different situations.

Unesco-Marc Riboud

Unesco-Marc Riboud

The drive in all modern countries to develop trade and a higher standard of living for all depends largely on the ability to make and exploit new scientific discoveries. In many countries a large percentage of higher educational resources is now being used to train professional scientists and highly skilled technicians. Photos show, from left to right, students at Moscow University listening to a lecture on organic chemistry.

HUMANITIES AS A COMPLEMENT TO SCIENCE

value. But it is difficult to avoid the conclusion that such beliefs, like scientific theories, must undergo change as Man's knowledge increases and his environment alters.

It is easy to say that Science should be welded to the humanities, but much less easy to suggest how this should be done. Each of us has a different view according to our particular interests. I confess that my own approach is based on personal experience.

About fifty years ago I chose to specialize in biology, and from time to time I have been asked "If you had known that you would spend a good deal of your later life studying the movements of animals, what subjects apart from biology would you have read at school and at the university?" The answer is simple: Apart from modern languages, I would have read physics, chemistry, mathematics and mechanical engineering.

The moral is that no young scientist should be allowed to forget that new discoveries tend to arise from the borderland between different subjects where the discipline of one is applied to another. Had I appreciated this I would have been a much better biologist, but whether I would have been a better human being is another matter.

If I am asked the 64 thousand dollar question, "Had you known that you would have had to adjust yourself to a rapidly changing and somewhat uneasy world, what *additional* training would you like to have had?", I think my answer would be that I would like to have been trained to think dispassionately about social and political affairs in the light of experience drawn from the past, and to have been taught to appreciate beautiful things.

But could I have acquired this knowledge whilst training as a scientist? Perhaps not, but I still think that I could have been shown a wider picture. Having been taught to visualize the spectrum in terms of the wavelengths of light, could not I have been encouraged to learn a little about colour as a source of aesthetic pleasure? Why learn about the properties of iron and carbon without reference to the Industrial Revolution? I might even have developed a taste for the classics if I had known that Aristotle had written a very good textbook of zoology.

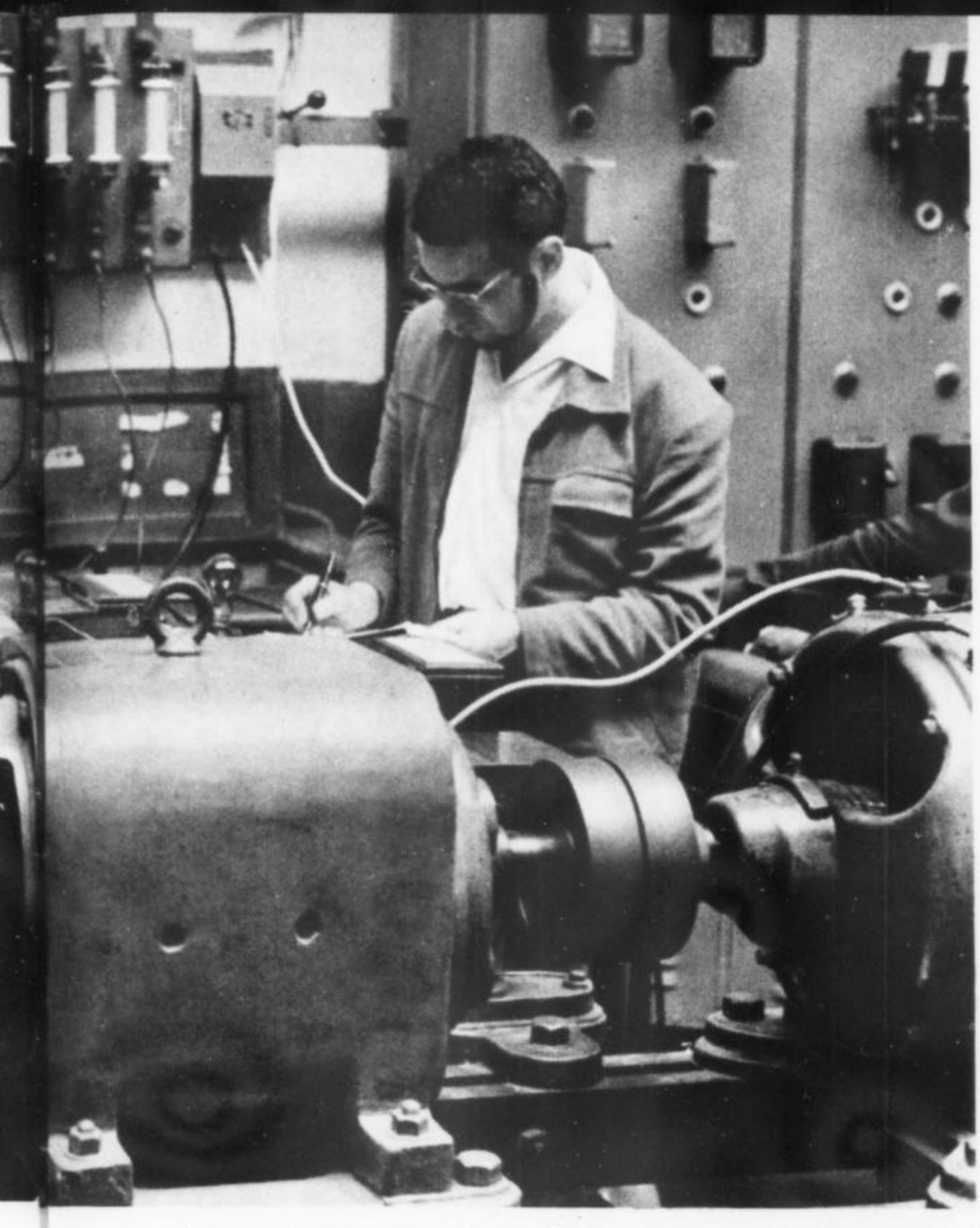
Perhaps I expected too much in hoping to appreciate an artist's view of Nature from the standpoint of a scientist. But I am not completely convinced. A scientist's attitude towards his observations does not seem to me to be so very different from that of a poet towards his words or a painter towards his colours; isolated observations have no more value than single words; it is only when they fit into a satisfying pattern that the scientist feels he has achieved his end.

If this argument is unconvincing, and if it still seems impossible to combine the vision of the artist with the outlook of a scientist, I can only suggest that Leonardo da Vinci and Sir Christopher Wren seem to have had pretty good *shots* at it. It would be very interesting to know the sort of training *they* had in early life.

But a plea for a wider outlook in the teaching of Science is nothing new. It was urged again and again in Great Britain by Sir Richard Gregory. In 1933 the declared aim of the London County Council was that they "wished their pupils to obtain a broad view of nature, to study mankind and his environment from various standpoints, more particularly from the point of view of both the biological and physical Sciences."

In 1946 the Advisory Council for Secondary Education in Scotland was even more explicit: "The study of man in his world, like the study of science, is a unity which should not be broken by any sharp division into 'subjects'... the theme must be one."

In 1958 a committee of the Science Masters Association urged that "The schools have the duty of presenting



Inge Morath © Magnum Photos, Paris

Unesco - Marc Riboud

student engineers using electrical equipment at the University of Grenoble, France, and a Japanese chemistry student concentrating on a laboratory experiment at Keio University. How to reconcile specialist training with a good all-round education—the kind that moulds opinions and equips to the greatest advantage the average boy and girl for later life—is one of today's problems discussed by Sir James Gray.

Science as part of our common cultural and humanistic heritage; it should be taught in harmony with and not in opposition to the various Arts subjects..." It seems fair to say that this is a goal towards which we would all wish to strive; but when we try to approach it the road proves extremely hard, and most of us, in practice, fall by the wayside.

We cannot shut our eyes to the fact that our national economy depends on our ability to make and exploit new scientific discoveries. If we wish to maintain or extend our standards of material comfort we must have more professional scientists and highly trained technicians and we must be prepared to devote an adequate fraction of our educational effort to get them.

But highly trained specialists form only a very small proportion of the population, and we may be paying for them in very hard currency if we have to deny to a very much larger fraction of the community a reasonable chance of "seeing life steadily and as a whole." A democracy has to decide how much of its total educational effort should be devoted to an ever-increasing standard of living and how much to raising the intellectual standards whereby the majority of the population forms its judgments on things which involve personal prejudice or political propaganda.

It is not easy to assess the factors which mould public opinion, but a recent enquiry indicates relatively clearly that the attitude of mind of an individual towards a changing environment is directly related to the nature and extent of his full-time education and that it is this training which largely determines, in later life, his response to other potential sources of education—such as libraries and broadcasts.

If we wish to awaken a widespread interest in Science, or still more, wish to contribute toward the formation of an enlightened public opinion, we must sow our seeds in the schools and in organized centres of adult education.

But the key to the main problem lies in the schools, and the responsibility resting on schoolteachers can hardly be exaggerated. Too many are asked to do two jobs at once—to provide a training for potential specialists and at the same time give a training which will best equip the average boy or girl for later life.

If we are to pay more than lip-service to the belief that a good all-round education is the best means of raising the intellectual level of the community, we must recognize that our most urgent need is for good general practitioners in the art of education. Really inspired teachers working with adequate but simple equipment will achieve more for general education than specialists in highly equipped laboratories.

But the scales have been heavily weighted in favour of specialization. Almost exclusively, our universities are producing specialists. Some of these return to the schools where they in turn teach on a specialized front. So the spiral of specialization has gone on. It is only natural that able teachers get an intellectual stimulus by preparing boys and girls for scholarship examinations and so providing recruits for fields of research in which they themselves are interested; but it is by no means clear that their work is necessarily more important, or more difficult, than that of those whose primary object is to persuade people that they cannot live by bread alone.

Much can be done by relatively formal teaching, but—if I may judge from personal experience—more depends on the extent to which people are given the time and opportunity to educate themselves by contact with men and women of entirely different interests and outlook.

But when all is said and done, Science can only make its full contribution to the welfare of mankind if it is used as a means of encouraging a dispassionate but optimistic attitude towards all aspects of human affairs. To move from national traditions and aspirations to others based on international welfare may prove less painful if we are prepared to look on Man and all his problems as a phase in the evolution of the universe and if we have the courage to believe and to teach that he can, by means of his intellect, control and direct his own evolution and destiny.

This text is an abridgement of an address, "The Proper Study of Mankind is Man", delivered in Sept. 1959 before the British Assoc. for the Advancement of Science.

WORLD TRENDS IN SCIENTIFIC RESEARCH

By Daniel Behrman

Science affects both directly and indirectly almost every human being. So vast is the field, and so rapid the growth of research in the past few decades, that it has been all but impossible to chart its progress. Now, a comprehensive survey of world scientific trends and technological research is being published by UNESCO. Prepared by Professor Pierre Auger, it marks a milestone in the history of international science and its uses for peaceful purposes.

THE Herculean task of taking a global look at the world of science, detecting the principal lines along which research is being undertaken in fields running from cancer to fluid mechanics and then charting a future course of international action has just been accomplished.

All this is under one cover and on 250 pages in "Current Trends in Scientific Research" which has just been brought off the press by U.N. and UNESCO. It is the work of a leading French physicist and former head of UNESCO's Department of Natural Sciences, Professor Pierre Auger, who has carried out this survey for the United Nations, following a resolution passed by the U.N. General Assembly in November, 1958.

Some idea of its scope can be obtained from the massive support which Professor Auger was able to enlist in collecting his data. Among contributors are numbered no less than twenty-nine intergovernmental organizations, sixty-six international non-governmental organizations, national research organizations from forty-two countries and, last but certainly not least in importance, 255 scientific experts from the world over.

But a much more vivid idea of what this survey was intended to encompass can be found in Professor Auger's own introduction to his book. It is quite simple: of all

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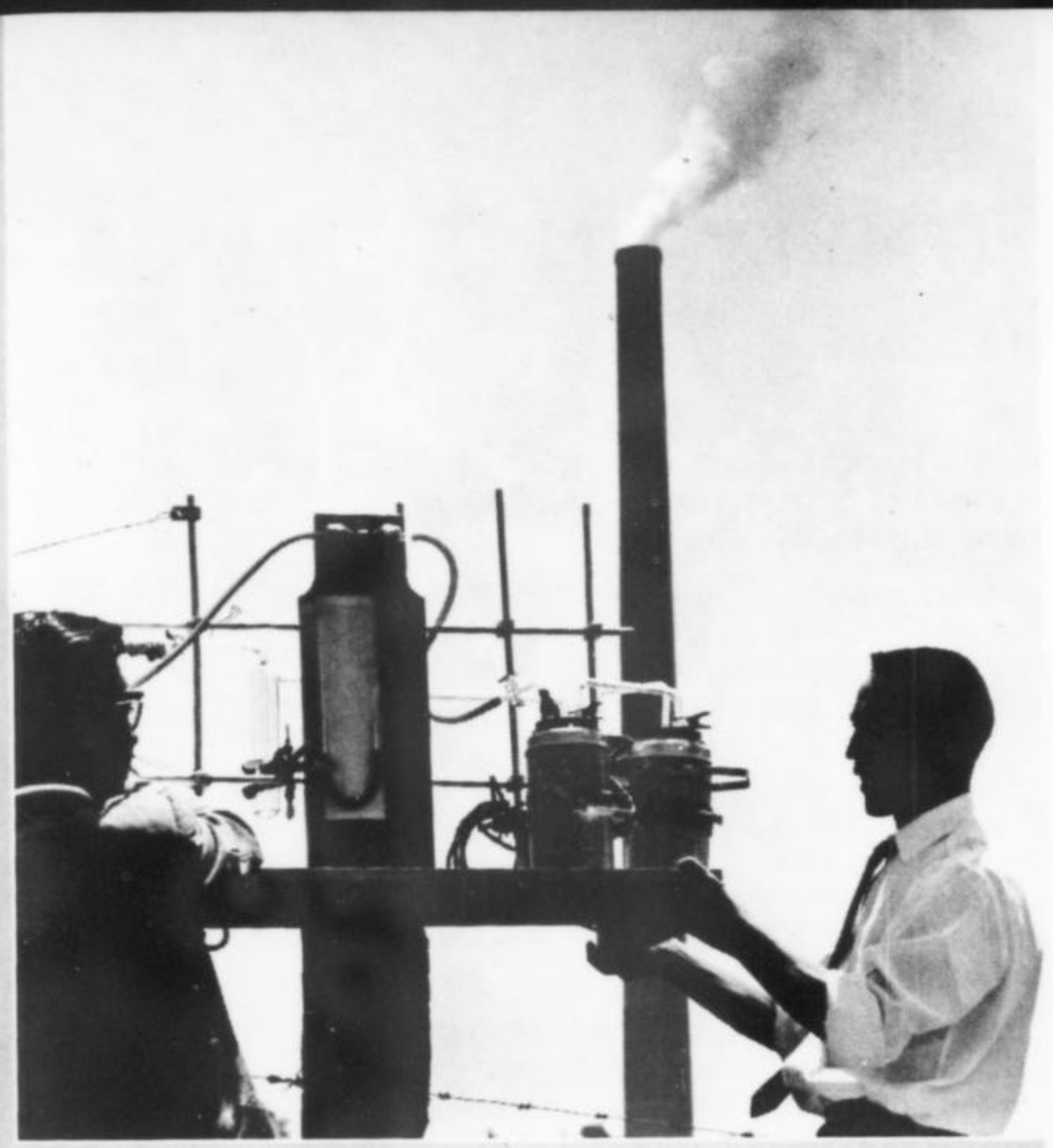
Radio-telescope, photo from "Poland Magazine".

Photos © Paul Almasy



Photos © Paul Almasy

The Institute of Applied Science in Mexico City develops and conducts research in meteorology, hydrology and related sciences in order to promote effective use of water and other natural resources. Modern laboratories and classrooms were made available by the University of Mexico in 1956, and Unesco has actively participated in the programme by providing experts, equipment and fellowships for Mexican scientists. Above, a scientist and his assistant take a sample of air near a factory chimney for chemical analysis. Left, one of the Institute's scientists adjusts an actinometer, a sensitive instrument for measuring the intensity of sunlight in different parts of the spectrum. Below, a solar radiation observatory on the roof of the Institute. The instrument in the foreground records the brightness of the sky. The circular metal band shades receiver from sunlight.

RECOMMENDATIONS FOR INTERNATIONAL ACTION

the scientists and research workers since the beginning of time, 90 per cent are alive and working today! In our world of rapid change, Professor Auger notes, scientific activity is increasing at the rate of ten per cent a year —which means that it more than doubles every decade. Merely keeping abreast of this activity has become an impossible task: while there were only 1,000 scientific journals in 1850, there are nearly 100,000 today.

"Current Trends in Scientific Research" is therefore neither a panorama nor an encyclopædia. It probably could be compared to a moving picture, edited from miles of film (in this case, mountains of data) to bring out the most important of all the events taking place before the camera's eye. Professor Auger has used another metaphor: when a ship gives its position, it reports its latitude and longitude but always adds its direction and speed. The position of modern research is not a fixed one.

In his recommendations for international action, Professor Auger has not necessarily selected the most important realms of scientific research but specific tasks which are beyond the reach of national or private efforts. Here, too, are to be found a number of fields which tend to be overlooked because they do not promise immediate returns in terms of national policy or economic benefits although their long-term promise is immense.

THESE are some of the highlights of his suggestions (unfortunately, space does not allow us even to summarize all of them) :

■ An international scientific conference to standardize measurements and remedy a "chaotic state of affairs".

■ An international system to enable countries to communicate their meteorological and seismological findings to electronic computer centres for processing. Professor Auger points out that such findings must be processed immediately if they are to be used by scientists seeking more knowledge of our environment.

■ More joint centres of high energy physics, such as the European Centre for Nuclear Research (CERN) originally inspired by UNESCO, which is now operating the world's most powerful particle accelerator.

■ An information service on current research work to avoid waste and duplication incurred all too often when institutes or laboratories in different countries spend years working on similar projects.

■ An international study of the long-term effects of small doses of radiation.

■ An international conference on artifical seismic shocks (earthquakes) induced by explosions. Interpretation of the results of such explosions is not yet clear.

■ The establishment of a major astronomical observatory in the middle latitudes of the Southern Hemisphere.

■ A scientific conference on cloud physics to assess the effectiveness of various methods now used to create "artificial rainfall".

■ A study of living conditions of certain populations not "enjoying" modern civilization to learn why the incidence of cancer varies from one country to another. This is urgent because traditional ways of life are dying out faster than they can be studied.

■ International measures for protection against pollution when it spreads beyond borders, as in the case of nuclear fall-out or river pollution.

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MOVEMENT TOWARD UNITY IN SCIENCE

■ Improvement of traditional methods of fertilization and soil improvement by placing them on a scientific basis and, at the same time, international research to increase productivity of plants.

■ An international co-ordination of research aimed at developing inexpensive nuclear fuels.

■ An international conference on problems of energy storage, especially those arising in intermittent sources of energy such as wind or sun. In addition, international support is needed for development of the direct production of electricity through the light or the heat of the sun (through photoelectric or thermoelectric cells instead of the inefficient cycle of the steam engine).

■ A series of steps to assist new countries to formulate scientific policy and to train scientists, technicians and engineers.

Despite this arbitrary summary of Professor Auger's recommendations, it should not be assumed that he produced his survey by placing scientific disciplines in arbitrary pigeonholes. On the contrary, he brings out very clearly that the trend of the past years toward specialization is now being accompanied by a parallel movement toward unity in science. The old barriers are falling with the growth of new sciences bearing such names as astrophysics, mathematical chemistry or physico-chemical biology. At the same time, the role of mathematics itself has broadened to the point where it pervades all sciences, substituting precision and prediction for groping.

Another barrier is also crumbling: the one between applied and fundamental science. While Professor Auger notes that applied research has grown to the point where there is a danger at times that it might squeeze out disinterested research—which would be as absurd as killing the goose that lays the golden eggs—there is now a fortunate tendency toward blending of the two.

The old distinction, therefore, does not stand up in the modern world. Professor Auger replaces it by a new classification of scientific research into four types :

—Free fundamental research or pure research; oriented fundamental research; applied research and then the final stage of development work to secure economic or social benefits. All are intimately linked.

On the basis of the survey, Professor Auger has brought out an even dozen main trends in world scientific research. He begins with the extension of physical frontiers, pointing out that, today, "the scientist can produce on the spot, in his laboratories, conditions which occur only in inaccessible regions such as the centre of the stars or the depths of the earth, or which perhaps do not exist anywhere in the universe".

Chemical frontiers, too, are being extended in the development of hitherto impossible purity of certain substances. At the same time, nuclear reactions have made it possible to extend the periodic table beyond 100 elements.

In both physics and chemistry progress is directly related to constant improvement in the accuracy of measurements which, Prof. Auger points out, automatically opens the way to new discoveries.

The third main trend is automation, a science in its own right. Not only is it revolutionizing industrial production, but it is taking the human error out of measurements.

The whole fascinating process of research on the earth's crust, the ocean depths, the polar regions and the vastness of interplanetary space forms a trend which Prof. Auger succinctly sums up in one word—exploration.

"Man against nature" is a fifth trend, englobing all of our efforts not only to explore nature but to force it into a mould suiting our purposes. This trend, Prof. Auger remarks, has already added years to the human life span.

The study of natural equilibria and cycles is a trend of increasing importance at a time when man is modifying these cycles by transforming water conditions, using up coal and oil reserves deposited over eons and stripping the earth of its forests. This research is essential to economic planning today.

Dwindling of natural resources has intensified a scientific trend aimed at increasing our supply of energy. This has already led to nuclear fission energy and to research on fusion or thermo-nuclear energy. Side by side with this search for new sources of energy is to be found revived interest in old ones: the sun, the wind, the tides and waterfalls.

The problem of energy, Prof. Auger remarks, was mastered by the nineteenth century. It is the twentieth century that is mastering, in another major trend, the analysis of the structure of matter. We can now "see" the structure of solids, liquids, living cells or molecules through new techniques of analysis.

While science studies existing structures, it is also devising new ones. This synthesis of complex chemical systems is giving us substances such as plastics which imitate or improve the properties of natural structures. Mathematical research is closely tied to this trend.

Transport is another main field and Prof. Auger divides current scientific research here into two aspects: electrical transport and material transport. Considerable work is being done to cut losses in the tranmission of electricity while there is a trend to simplify the movement of materials through the use of giant tankers or huge pipelines.

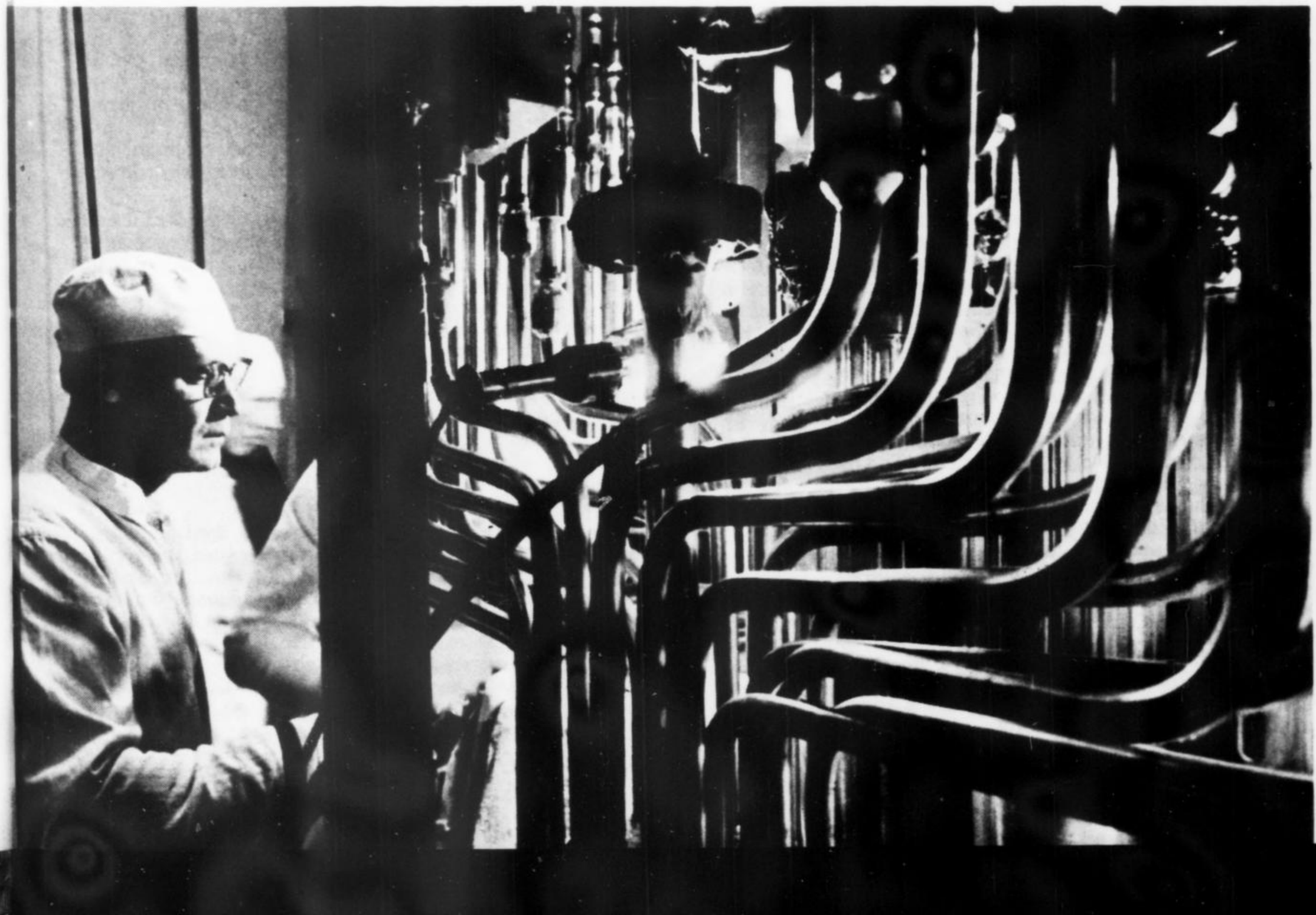
Communications, termed by Prof. Auger as "the transport of complex patterns", are also leading scientists to seek ways of reducing losses in transmission. At the same time, methods must be found to move an increasing number of "messages" of all kinds over a limited spectrum of usable waves.

Finally, Prof. Auger singles out the interaction between the various sciences themselves as his twelfth main trend in the world of science, with mathematics in a royal role. "Almost as if they could foresee the needs that would gradually come to be felt by physicists, chemists and biologists," he remarks, "the mathematicians have almost always evolved in advance the purely logical theories containing the required tools of thought."

In the eyes of Professor Auger, these present trends in science are not creating a science-fiction world dwarfing man into insignificance. On the contrary, he stresses that human biology is to be found at all levels of pure and applied research today. Automation has not replaced the observer and the demands of the human mind are the very source of fundamental discoveries in science.

The interaction of all sciences and this emphasis on man are two overall movements which, the author of the report concludes, "are jointly making a powerful contribution to the unification of scientific thought".

Industrial research plays an ever growing role in the application of scientific knowledge to man's needs. Above, an industrial hygiene specialist at the University of Rochester in the State of New York, U.S.A., studies harmful air-borne particles from certain factories and prepares to count the concentration of dust particles by plating them with metallic selenium. Such research also includes testing the toxicity of dusts on animals. Below, this maze of tubing is part of the instrumentation apparatus atop the head of a nuclear reactor in an American atomic-electric generating plant. The tubing feeds information from the reactor to the control room where readings are automatically recorded on charts and gauges. Scientific research plays a direct part in the development of nuclear power as in the automation of industry.



KALINGA PRIZE

A SCIENCE REPORTER SPEAKS OF 'BABELOGY'

by Ritchie Calder

On June 20 during an impressive ceremony in Unesco House, Paris, Ritchie Calder, the British science writer, became the ninth winner of the annual international Kalinga Prize for the Popularization of Science. At this ceremony, Ritchie Calder was told by Mr René Maheu, Acting Director-General of Unesco: "You have the gift of describing the most intricate scientific problems in a way that appeals both to the reason and feelings of the public and arouses curiosity and surprise." Some of Ritchie Calder's books, said Mr Maheu, had been translated into 12 languages and dealt with every aspect of scientific research from tropical medicine to the hydrology of arid zones and the biology of the Far North. His reports had appeared in over 1,000 newspapers in some 40 countries. The Kalinga Prize, donated by Mr B. Patnaik, of the Orissa Legislative Assembly, India, offers recognition to leading interpreters of science whose works have shed light on the social implications of scientific progress. The winner is chosen by an international jury of scientists and editors of popular science journals appointed by Unesco. Previous winners include: Louis de Broglie: (France), Julian Huxley (United Kingdom), Waldemar Kaemppfert (United States), Augusto Pi-Suner (Venezuela), George Gamow (United States), Bertrand Russell (United Kingdom), Karl von Frisch (Germany and Austria) and Jean Rostand (France). Traveller, writer, journalist, film-maker and lecturer, Ritchie Calder was science editor of the "News Chronicle" in London, 1945 to 1956, and of "The New Statesman and Nation" from 1945 to 1958. Aged 54, he is now Professor of International Relations at Edinburgh University. His books on scientific subjects include "Men Against the Desert", "Men Against the Jungle", "Science Makes Sense" and "Profile of Science". His latest work, "The Inheritors", tells the story of man and the world he made. Many of his articles have appeared in The Unesco Courier. On these pages, we publish salient passages from Ritchie Calder's address at the Kalinga Prize ceremony.

I regard myself as a reporter, recently translated to academic life but claiming none of the academic distinction of the eminent scientists whose names emblazon the roll of the Kalinga Prizewinners. Rather do I count myself in the succession of my late friend Waldemar Kaemppfert, the third recipient of the award. As science-editor of the *New York Times,* he was the doyen of our craft, who set the standards of integrity and lucidity which I have tried to follow and who faithfully respected the international character of science, and who believed as I do that the mere explanation of science is not enough; its meaning has to be translated into the lives of ordinary people.

I have long since given up apologizing for the fact I had no formal scientific education or training. If someone with an education as limited as my own could, in time, understand the mysteries of science, so with patience and the use of the common-tongue, laymen the world all over can have the veils of science lifted. There have to be interpreters. They may be academic scientists, of whom notable examples are to be found among the Kalinga Prizewinners; or they may be scientists who, with a full training and with degrees, turn to professional science-writing as a career; or they may be trained journalists, who, like myself, discover an interest in science, and learn to explain it to that much-maligned, misunderstood, anonymous creature, "The Average Reader."

But exposition is not confined to the written word; there is the spoken word, of the platform and the radio; and there is the power of the visual, of the film and of television, with the capacity to share the experience of the scientists with the millions of viewers, to bring to them some of that excitement and the awe which comes to the experimenter in the laboratory—or in Space—when the unknown becomes visible under the microscope or on an oscillograph. We are only at the beginning of this shared adventure which is science-exposition.

It needs patience—patience on the part of the scientist who has to explain; patience on the part of the expositor who has to win and pass on that explanation; and patience on the part of the reader or the viewer who has to be wooed into an understanding of the discoveries and developments which are dominating and revolutionizing his life and the society in which he lives.

The tools of my trade as a science-writer have been—apart from a typewriter—three questions: "What are you doing?" "How are you doing it?" and "Why are you doing it?" With patience on the part of the scientist and patience on the part of the inquisitor, there are few things in science, however apparently abstruse or novel or difficult, which cannot be explained in comprehensible terms.

One of the major difficulties is the terminology—the jargon of science. The scientists in the various branches and disciplines of science have invented their own language of convenience. Where once the terms were descriptive they are now cryptic—sometimes one feels that like the code names for military operations, they have been deliberately invented to mislead and, like the sign language of the mediaeval crafts, designed to preserve the inner mysteries for the few.

Sometimes—like "barn" in nuclear physics or "hardware" in the jargon of the electronic engineer—they are survivals of common-room jokes. Sometimes they are borrowed, like the confiscation of the word "plasma" by the physicist from the biologist. What the scientist, who in the restricted company of his colleagues uses them as commonplace terms, does not always realize is that such words are like index cards; to him they convey a whole filing cabinet full of meaning but he forgets that others do not have access to that filing cabinet.

This is, alas, inevitable. With the proliferation of science, the scientist is entitled to his "language of convenience" but he must, when necessary, define those terms. A century ago, any man of science was intelligible to any educated man—that educated men were an élite is another matter; terms had a common-root etymological meaning and in that sense were descriptive. Today, I repeat, they are cryptic.

I have sometimes described myself as a "babelologist," a student of that babel of tongues which is science. I also boast that I am an expert on experts—one who knows to whom to turn for the information one has not got. In that I personify the science-reporter, who is the trustee, for the common man for whom he seeks enlightenment in the common tongue: who never relies on what he knows but turns to the expert sources for current guidance; and who does not make the mistake which many academics do of confusing ignorance with lack of intelligence.

I HAVE, after thirty years of trying to explain science, a reinforced confidence in the capacity of ordinary people to grasp what is made intelligible—provided that their interest has been enlisted and their imaginations illumined. But that after all is surely the essence of all good teaching.

May I be more profound? The crisis of our times is the break-down of communications—not just in the sense of political barriers, but in this all important area of science. Our lives, our hopes, and our survival depend upon the uses which are made of science. To progress, we have to use scientific knowledge and discovery to its utmost advantage. Science, in the advanced countries, is developing so fast that it is almost impossible to keep pace with the knowledge—and the gadgets—which are aggregating. I believe that some 3,000,000 original scientific papers a year are published. No one can compass so much information.

The various branches of science are out of step. Cults of science are developed and encouraged by disproportionate budgets. Large areas of science are enclosed in the compounds of military security; others are segregated merely by over-specialization; the fences are up. One set of scientists does not know what another set is doing, and yet there may be an important affinity of material value to mankind.

There are too few communicators *within* science and the bridges are broken between the humanities and science. Those who have to make the social judgments about science have usually no scientific training—worse, their own education makes them feel that anything which involves such intensive training is beyond their comprehension and that they must "rely on the expert". But there is little in the training of the scientist, preoccupied with all that has to be learned in his own subject, which gives him the capacity for social judgments.

We are in danger of being subjected to the tyranny of the experts—faceless men at the elbows of the uninstructed. They are not tyrants by disposition but by our default. How are we to teach people enough about science to allow them to make judgments, to decide priorities, instead of encouraging cults by gusts of emotion, and to see that, with the inalienable rights of curiosity and the quest for knowledge unimpaired, science, with all its potential for good or evil, is directed to the advantage of mankind?

How much more resources and attention should we be giving to the problems of this planet on which 4,000,000,000 people will have to contrive to live 20 years from now? Is space adventure more important than the food and population problem, for instance? This is not a question of one or the other but of how much? And how, with all the spectacular advances of today, can we close the widening gap between the prosperity of the scientifically advanced countries and the impoverished ones?

These are social judgments fraught with stupendous consequences, and they must be based on the understanding of science and what it can make available.

Without arrogating to the science-writer all the wisdom of the world, it is true that he has the opportunity for better understanding. He is a "synoptic scientist"; he travels across the advancing fronts of all branches of science and can see, at first hand and in survey, what preoccupied scientists cannot see for themselves and what men of affairs can never see panoramically. His job is to pass that knowledge on—either along the line of science or to the public. He is, by the accident of his trade, as a collector and disseminator, the prototype of what should exist in academic and public life, the communicator of information on which judgments can be made.

In his own working life, his function is to convey to the mass of the people the facts about science but also, I suggest, to convey an interpretation of the social implications of new developments. I know that many of my colleagues think that they should confine themselves to description and explanation and leave the value judgments to others. I disagree profoundly. Our access to information, our point of vantage on the scientific scene gives us responsibilities which, in the present situation, we must not shirk.

I am still by instinct and by training a reporter. My work as a journalist opened the once-closed doors of science, but the insight and experience which I gained opened for me doors on to a wider world. For the past 15 years, I have had the privilege and opportunity of travelling round the world, mainly for the United Nations and its agencies, to see how science and technology can help the less-developed countries to achieve material well-being for their people.

That combined experience is what I am now taking into university life as Professor of International Relations at Edinburgh. The only "international relations" I am qualified to teach is how by the common understanding of science, and by the proper application of that knowledge to the common needs of mankind, we may achieve a greater common understanding between peoples. In that purpose, I am confirmed by the Kalinga Prize, awarded to me because that is what its founder hoped to encourage.

IN A HONG KONG MEDICINE SHOP

A TOOTH WAS THE CLUE

by Prof. G.H.R. von Kœnigswald

A leading anthropologist and paleontologist, Professor von Kœnigswald has done extensive field research in Indonesia and South China, where he made important finds concerning Peking Man and the Pithecanthropus-Group in general. He has occupied the chair of anthropology at Utrecht University since 1948.

Just over a century ago, in 1856, a skull was brought to light in the Neanderthal, near Dusseldorf, Germany. It was unmistakably a human skull, but so different from that of modern man that most scientists had no hesitation in identifying it as belonging to a type of human being who no longer exists today. The discovery of the Neanderthal Man was a red-letter day in the history of man's efforts to delve into his past and to record everything connected with it. Since then the search has gone on everywhere, and many remarkable discoveries of science stand out as landmarks in the history of mankind over the past 100,000 years.

But the story of what happened to man before this time is less well known. The oldest undoubtedly human remains are only about 800,000 years old and discoveries dating back to earlier periods are of doubtful value. Even so, scientists have unearthed at least enough material to be able to reconstruct about one million years of human history. This seems like a staggering length of time until we remember that the evolution of horses can be traced back some fifty million years and that of elephants for over forty million.

Our own history, too, goes back a very long way but much of the evidence we would need to reconstruct it still eludes us for various reasons. For one thing most of the remains discovered are very incomplete: single teeth and a few jawbones and skulls, most of which are fragmentary. Not one complete skeleton of the older types is known.

Another reason is that discoveries have been made in all parts of the Old World, from England to South Africa and from Spain to Northern China. Thus this branch of scientific research has become, in the fullest sense, an international one. Only by pooling all discoveries can we hope to turn a spotlight on our distant past; the true and complete solution to this great enigma can certainly not be reached from evidence collected within the frontiers of one single country.

There is a third factor which greatly complicates the work: the problem of determining the age of the sites in which finds are made and the need to make a comparison of sites which are vast distances apart. We therefore make studies of extinct mammals discovered in association with extinct men. But as can be imagined, it is difficult and often impossible to decide whether an archaeological site in, say, Java, is older than another one in South Africa. The difficulty of placing finds in chronological order and of interpreting fragmentary relics means we are faced with a variety of alternative conclusions and this has led to wide controversy over the significance of certain finds.

Disagreement exists, for example, over the remains of an ape found in the lignite deposits of Northern Italy. Unlike living anthropoid apes, this one has a remarkably small eye tooth, and other aspects of its dentition are similar to those found in man. Is this really a predecessor of man, ten million years old, as some half-informed and sensationalist newspapers would have us believe? Specialists capable of judging the discovery are by no means all of this opinion. The preparation of a skeleton, which one of our Swiss colleagues has discovered, with much effort and expense, is still not quite finished, but it already shows extraordinarily long forearms.

Where can we hope to find the remains of our forefathers? The richest treasure troves are caves where men sheltered, especially during the last Ice Age, and where they buried their dead. But cave homes are generally not more than 100,000 years old.

In the deepest strata we find Neanderthal man who is only a step removed from us. He was smaller and more stockily built than we are, his chin was lacking and he had a massive, jutting brow in front of a low forehead. His only implements were of chipped stone and he had not learned to make pottery, but he already believed in a life after death. He buried his dead and gave them the best of tools and food for their journey into eternity.

This is why Neanderthal Man is the only fossil man of

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Photos G.H.R. von Koenigswald

Strange as it may seem, some of the most remarkable clues to man's earliest ancestors have come from Chinese medicine shops where "dragons' teeth" (remains of fossil animals) are collected, ground up and sold as medicaments. From these shops came the first tooth of Gigantopithecus and also the teeth of Peking Man. In 1935, Dr. von Koenigswald combed these "archaeological treasure houses" in the Western Market of Hong Kong (left) for traces of early man. Among the canine remains of panda, bear, tapir and orang-outang he found the upper molar of giant ape, Gigantopithecus, shown (enlarged) at right alongside a human molar. Above, a tooth of Peking Man (arrowed) among other "dragons' teeth" and a recipe.

GIANT MAN OR GIANT APE?

whom we have a complete skeleton. In the case of all older discoveries we have only isolated remains—mostly of the victims of accidents. Thus we find human bones in limestones, and buried in sandstones and gravels and rock fissures.

We also find them in medicine shops and these "paleontological treasure houses" are certainly the most remarkable of all. I am, of course, not talking about just any apothecary shops, but about Chinese ones where almost anything which the vegetable, animal and mineral kingdoms of China have to offer can be bought.

Such remains are used as ingredients for medicine and, to judge by the overpopulated state of China, they are no more dangerous than our own remedies. Among various other medicaments "dragons' teeth" are highly prized. These are not, as their name might suggest, the teeth of saurians and other large reptiles, but the fossilized remains of extinct mammals. It is already over a century since specimens of this kind gave us our first insight into the fossil mammals of China and they have since proved to be important links in the research chain leading us back to fossilized man.

WHEN I was working as a geologist in Java, we became very interested in "dragons' teeth". Did they, we wondered, come from Java or from China? We soon found that they all came from China but when we went into the question more closely we found that in ancient China there were once animals which are still living in Indonesia. The most surprising example was the orang-outang, the large anthropoid ape, which still inhabits Borneo and Northern Sumatra.

To be absolutely sure that these remains came from China, a visit was made to Hong Kong in 1935, and the large apothecary shops in the "Western Market" were thoroughly combed. The result was astounding. The harvest included teeth of orang-outangs, tapirs, the Malayan bear, Panda (the friendly Bamboo bears) of deers, pigs, tigers and many other animals. But not one single jaw could we find. Large porcupines had gnawed away all the bones and teeth roots and only the crowns of teeth remained. It was clear that all this material must actually have come from Southern China.

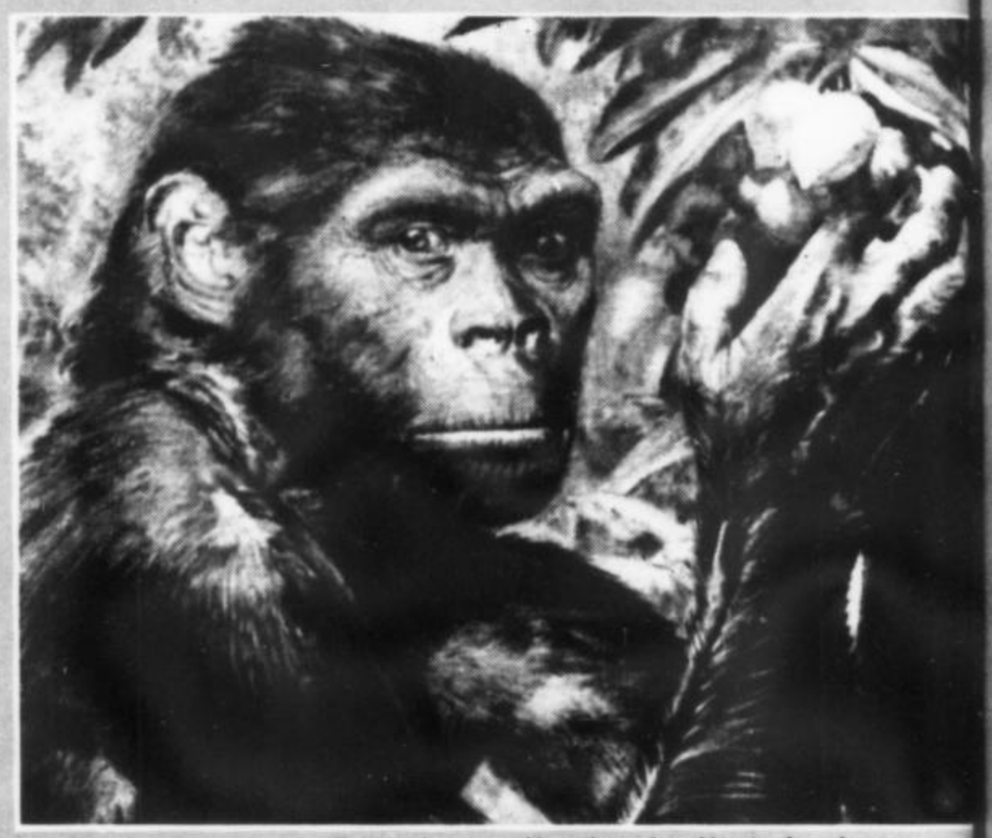
The largest of all the ape teeth found had a smooth surface instead of the fine wrinkles found on an orang-outang's teeth. I immediately felt sure that we had come across a new type of ape of enormous size. Subsequently, in 1935, on the basis of this single find I described Gigantopithecus, the giant ape of the Chinese apothecary shops.

Some of my colleagues disagreed, declaring that the tooth was much too large for an ape, and one of them, Professor Weidenreich, at first maintained that it was simply that of a very large orang-outang. I made further journeys to China, and in Canton I found a magnificent upper molar, and in another apothecary shop in Hong Kong an unworn lower molar. In certain respects both these teeth show much resemblance to the teeth of man, and Weidenreich, who had been so sceptical at first, completely changed his opinion, saying that he now considered my Gigantopithecus to have been a huge man. One German anthropologist even wanted to change the name to Giganthropus (anthropus—man; pithecus—ape), and even made a fantastic reconstruction of the jaw bone.

Finally, 22 years after the discovery of the original tooth, we were able to reach a more positive conclusion. On February 17, 1957, my old friend and colleague, Dr. Pei Wen Chung, exhibited in Peking an enormous jaw which had been found in a cave in Kwangsi, in Southern China. It was a lower jaw with a somewhat less specialized anterior dentition than that of the living anthropoid apes. But it was an ape: the tooth found in the Hong Kong chemist's shop had not lied.

The Kwangsi jaw is larger than that of a gorilla, which means that Gigantopithecus itself was larger than

Von Kœnigswald, Utrecht



Taken from : *Menschen der Urzeit* by August and Burian, published by Artia-Verlag, Prague 1960

Above, a reconstruction of the Java Pithecanthropus made by Professor Z. Burian of Prague. Its forehead was flat and the skull, though lower than that of modern man, was about the same length and width. Below, child's skull of the Australopithecus group found in South Africa. The name means "Southern ape" (Austral-south; pithecus-ape) but recent discoveries show Australopithecus was similar to man and could walk upright.

Von Kœnigswald

In 1937 at this site in Central Java, Dr. von Koenigswald solved a 40-year problem that had puzzled scientists ever since a flat-topped skull and thigh bone of Pithecanthropus Erectus had been found elsewhere in Java. Was this man or ape? The answer was man. It was confirmed by later discoveries of Dr. von Kœnigswald.

Photos von Koenigswald and © L.J.B. Leakey, Nairobi

Three skulls which show that Asia and Africa (and Europe) were all inhabited by the primitive man, Pithecanthropus, half a million years ago. Top, skull discovered at Olduvai, Tanganyika, by Dr. L.J.B. Leakey in 1960. Centre, skull discovered by Dr. von Koenigswald in Central Java in 1937. Bottom, skull of Peking Man (Sinanthropus) found near Peking in 1929, curiously similar to the Java find.

40 YEAR CONTROVERSY OVER A FOSSIL SKULL

this ape, the largest and most powerful of anthropoid apes living today. My Chinese colleagues estimated that it must have been at least three metres tall. I am still getting letters from people asking whether Gigantopithecus might not have been the "abominable snowman" from the Himalayas, and people are very disappointed when I have to tell them that I do not think so.

Another discovery was made which, although perhaps not so dramatic, was no less fruitful. In 1900 a German engineer named Haberer brought back a large collection of "dragons' teeth" to Germany and our first extensive knowledge of the fossil mammals of China is based on the description of these specimens. The most remarkable item was a human tooth, extremely worn and apparently very old. It too had come from an apothecary shop in Peking, and the search for the fossilized remains of human beings was therefore concentrated on this area.

This led to a now celebrated event: the discovery of the Peking man (Sinanthropus) of which, in the first place, a single tooth had been unearthed. This was claimed by Professor Davidson Black to be a hitherto unknown fossil man. A skull found in 1929 by Dr. Pei, who made many other important discoveries, proved that Black was right. Successful excavations are still being made today on the same site.

The teeth of the Peking man are very large and similar to some of those found among our apothecary shop specimens from Hong Kong. There were also smaller teeth and because of the red clay which was found on one part of the jaw, Father Teilhard de Chardin (whose name is also linked with the discovery of the Peking Man) identified it as coming from a Late Stone Age horizon which is often to be found in caves. This was the jaw of a "modern" man, only a few thousand years old. One of the teeth is so similar to the first tooth found in the Peking apothecary shop that both must have come from the same strata. It was, therefore, a modern tooth which put us on the track of Peking Man!

The discovery of the Peking Man brought the solution to an earlier problem: whether the remarkable flat skull cap dug up in Java by E. Dubois in 1890 was that of a man or an ape. In 1891 an indisputably human thigh bone was added to the earlier find though there was no direct proof that both discoveries belonged to the same subject. Dubois combined the two and his "erect walking Java Ape-Man", the Pithecanthropus erectus, remained the most controversial fossil for nearly 40 years.

THE main reason for this was that the ear region of the Java skull was missing and it is precisely this part of the skull which makes it possible to reach a clear decision. In the case of the Peking man a complete skull was available and in spite of his primitive characteristics he was, anatomically speaking, indisputably human. This is also shown by the simple stone implements and the layer of ashes found at the place of discovery, which makes it clear that he already knew about tools and fire.

The shape of the Peking skull was so similar to that of the controversial Java find that Black concluded that the Peking Man and the Java Man must have been close relatives. The remarkable thing was that Dubois, the discoverer of Pithecanthropus, disagreed with this theory. Although he had always previously defended the human characteristics of his find, he now denied that it was related in any way to Peking Man and even went so far as to declare that his Pithecanthropus was an ape.

The only way to resolve such a confused situation was to redouble our efforts in searching for the Java Man. We found a promising site in Central Java with exposed strata in which there were many remains of the same extinct deer, antelopes and elephants as those discovered by Dubois in association with his Pithecanthropus.

For years we worked in this area. During the rainy season the downpour of water scattered the loosened

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AFRICA, EUROPE AND ASIA ALL KNEW PITHECANTHROPUS ERECTUS

fossils over the hillsides and we eagerly went to work, soon assembling a large collection of teeth and bones of extinct animals. This included the remains of hippopotamus—no longer found in Asia—various elephants, deer, pigs, tigers, rhinoceros and other animals.

Then, one day in September 1937, we made an important find. One of my enthusiastic Indonesian collectors came across a piece of skull. The next day I hastened to the spot and promised the workers ten cents for every piece of skull they brought me. I myself soon found a large piece of the frontal bone, but my collectors only brought me small fragments.

Too late I discovered what happened; the workers had broken up all the larger pieces in order to make more money! I was eventually given more than 40 pieces, but fortunately there was very little difficulty about joining them together since the skull was over one centimetre thick.

It soon became clear that we had actually found a second Pithecanthropus skull. It would be difficult to find two skulls in a modern anthropological collection which are so completely alike as Pithecanthropus I and II, although the places of discovery were 30 miles apart. The new find was finally complete enough to include the ear regions on both sides of the skull. One glance was enough: Pithecanthropus had undoubtedly been a human being. After 46 years the puzzle had finally been solved.

THE Pithecanthropus-Group which lived between 400,000 and 600,000 years ago, had a thick brow with strong supraorbital ridges. The forehead was flat and the skull, though lower than that of modern man, was about the same length and width. Owing to the thickness of the skull bones, the space available for the brain was very limited: Pithecanthropus had a brain capacity of from 750 to 1,100 cubic centimetres; modern man's is between 1,350 and 1,500.

A whole series of lower jaws of Peking Man were discovered—unfortunately the best of these specimens were lost during the Second World War—and studies of these revealed that they had a common link with other famous discoveries. It became clear that the celebrated Heidelberg jaw—Europe's oldest and most primitive human relic—discovered in 1907 and the large Ternifine mandibles from Algeria, recently discovered by Professor Aranbourg and described as a relic of Atlanthropus, belonged, like Peking Man, to the Pithecanthropus-Group.

That this group also occurs in Central Africa was shown by the latest find of Dr. L.J.B. Leakey which has just been announced. In the Serengeti steppes of Tanganyika there is a gorge about 100 metres deep known as the Olduvai Gorge. This has been cut through a thick layer of horizontal strata, the majority of which had been deposited in an old lake basin. In addition to numerous remains of fossil mammals, most of them extinct, there are also stone implements here.

Dr. Leakey, the curator of the Corydon Museum in Nairobi, who discovered and described these remains, found no less than ten different levels containing stone implements. In the deepest strata we find simple pebbles which have been converted into a cutting tool by having the two sides knocked off. These are the implements of the "Oldowan culture" and the higher the stratum the better are the tools. First of all we find large hand axes of the "Chelles Culture", with their irregular cutting edges, and higher still the thin oval axes with the straight edge of the "Acheul Culture".

These last two cultures were also known in Europe and derive their names from the French places of discovery. But nowhere in the world can the evolution of the hand-axe cultures be followed step by step as they can in Olduvai. I was able to visit the diggings under Dr. Leakey's guidance and it was an unforgettable experience.

Who made these stone implements? Although Dr. Leakey began his research shortly after World War I, it is only in the past few years that decisive discoveries have been made. A skeleton discovered there in 1913 proved to be of too recent interment to have any significance.

We can deal here only with the two most important discoveries at Olduvai, the first of which was made in 1959 by Mrs. Leakey. This was a skull which came from the lower stratum of the primitive "Oldowan culture". Zinjanthropus, as Leakey called it, surprised us all for it had a small ape-like skull (brain capacity about 600 cubic centimetres) with a low crest, a large, coarse face and powerful teeth. The molars were actually almost twice as large as those of modern man while the eye teeth and incisors were disproportionately small. Leakey gave this find the name "Nutcracker man" on account of the extraordinary dentition.

As a type, Zinjanthropus was by no means unknown to us. We had already seen such examples of the Australopithecus-Group from deposits found in rock fissures of South Africa. The name literally means "Southern ape" (Austral—south; Pithecus—ape), and reminds us how controversial these first discoveries were, though it has been shown by new discoveries that Australopithecus was similar to man and could even walk upright.

All members of this group have small brains and large jaws. The result of this combination is that the bunches of muscles for moving the lower jaw meet together at the top of the head and form between them a bony ridge—the crest already mentioned.

Similar conditions are found among anthropoid apes. Among the forerunners of men we find a constant decrease in the size of the chewing apparatus and a marked increase in cranial capacity—in other words, precisely the opposite trends.

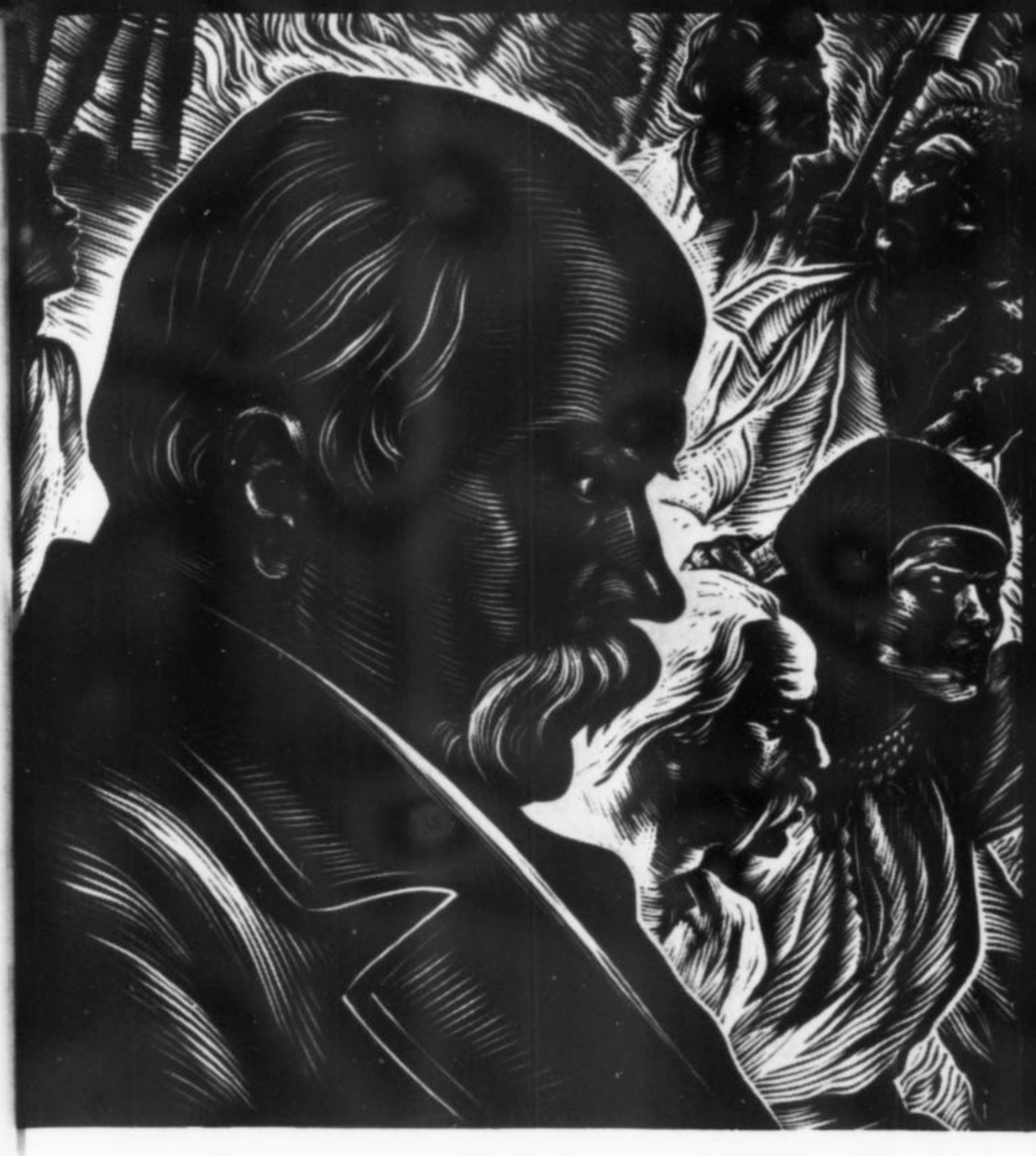
For these reasons we consider—and I believe that most of my colleagues will agree with me—that Australopithecus was a side branch of the human family tree which died out, and not a direct predecessor of Pithecanthropus, still less of Homo sapiens, the modern type of Man. Specimens of the Swartkrans Australopithecus, also known as Paranthropus, have a crest-like ridge exactly like that of the Zinjanthropus found at Olduvai.

NEVERTHELESS, Australopithecus is a primitive man and this at once raises a difficult query: did Australopithecus make implements? Various authorities have provided different answers to this question; however, the possibility that he did use tools should not be ruled out. But we now face another problem. Was it really Zinjanthropus who was responsible for the Oldowan culture? Should we consider him as a logical predecessor of the hand-axe culture, which certainly has nothing to do with Australopithecines?

As we were expecting, this last supposition has now been confirmed by the latest discovery at Olduvai. On December 2, 1960, Dr. Leakey found an almost complete skull along with primitive hand-axes of the "Chelles Culture 3." Though no detailed scientific description has yet been published, the striking resemblance between this new find and the skulls of the Pithecanthropus Group is obvious from photographs.

This would provide a link with the North African discoveries, for the lower jawbones of Atlanthropus (found in Algeria) are comparable to those of the Peking Man. It can therefore be assumed that the new find is related to Atlanthropus, also discovered along with primitive hand-axes, or rather with its forerunners. In comparison with the Asiatic Pithecanthropus, the Olduvai skull seems to have much heavier bony ridges above the eyes.

Thus, these latest discoveries show us that Asia, Europe and Africa were all inhabited by primitive Pithecanthropi as much as half a million years ago, long before metal was discovered—and before the invention of radio and aeroplanes which today make it so easy and so difficult for us to get together.



TARAS SHEVCHENKO

UKRAINE'S POET OF FREEDOM

by Pauline Bentley

A hundred years ago a poet who was one of the world's great champions of freedom died in St. Petersburg. This year, his centenary is being celebrated not only in his own land, Ukraine, but throughout the Soviet Union, and in many great cities of the world including the American capital, Washington, where a statue is to be raised in his commemoration. This man's name is Taras Shevchenko, the Ukrainian poet and patriot who not only established his country's literature high among world letters, but who actually lived his poetry. A torchbearer of liberty, his whole life mirrored the sufferings of his oppressed country and the unconquerable, indomitable will of its people to freedom.

The vast territory of Ukraine with its population of 40 million stretches from Poland and Czechoslovakia to the Black and Azov Seas, and is the second largest nation within the U.S.S.R. Of it Voltaire wrote "L'Ukraine a toujours aspiré à être libre", for its history is one of endless invasion and national effort to throw off oppression. Its literature goes back to the tenth century but at that time it mostly made use of an artificial language based on the ceremonial Church Slavonic; only in 1789 (the year of the French Revolution) did the Ukrainian writer Kotlyarevsky introduce the spoken language in literature and so lay a foundation for Shevchenko to elaborate on.

Taras Shevchenko was born in a village near the banks of the Dnieper in 1814; he was born a serf, a scrap of humanity without rights or privileges, belonging entirely to the local landlords. It is perhaps difficult to imagine what harsh misery the enslaved poverty of serfdom meant to the Ukrainian peasant at this time, but the waves of change which had brought American Independence and the French Revolution, which had washed away the old autocratic orders in Europe and North America, had rippled to stagnation before reaching the East.

In 1814 Ukraine was still a feudal land under Tsarist tyranny. The fertile beauty of the countryside of Taras' childhood stood in cruel contrast to the living conditions of his people but both these aspects of the life around him affected him deeply; from one he learnt a passionate patriotism, a love of his country which was to remain undimmed by exile or absence, and from the other he learnt a hatred of tyranny, of oppression and injustice which inspires his poetry with the divine fire of liberty:...

O dear and quiet land
O my Ukraine
Why do they plunder thee?
Why has death come to hut and lea?...

... Break your chains and live as brothers.
In a foreign country
Do not seek and do not search for
What is non-existent...

In your home, you'll find your justice
And your strength and freedom...
The world has only one Ukraine
Dniepro cannot be found elsewhere...

As a boy Taras showed early a vivid imagination and a passion for drawing. When he was left an orphan at the age of twelve, he sought a teacher and from a brutal drunken clerk did learn to read and write though this man's harshness finally drove him elsewhere. He quickly exhausted the meagre local sources of learning open to him and after a disconsolate spell of village cattleminding, he was summoned to work as scullion in the manorial kitchens. From there he attended the young master, Pavel Vasilyevitch Engelhardt, who took him as part of his retinue on his travels.

A new world opened up before Taras; he wonderingly absorbed all he could of this unaccustomed grandeur, and secretly studied the art treasures housed round him. One night in the Engelhardt establishment at Wilno, the master returned late to find Taras absorbed in copying a print by candlelight. He had the boy flogged next day for his temerity but was so impressed by the quality of the copy that he decided to allow Taras to study with the Wilno painter, Rustem, and later, on moving to St. Petersburg, apprenticed Taras to the painter Shirayev, a harsh and cruel master who turned his pupils into drudges.

Taras had little leisure, but in the white nights of the early summer he would go to the Summer Gardens of St. Petersburg to sketch the ancient statues there for his own pleasure. It is on such an occasion that he is said to have met a fellow Ukrainian, Ivan Soshenko, who was studying at the Imperial Academy of Arts.

CONT'D ON NEXT PAGE

POET OF A PEOPLE'S SUFFERING

Soshenko introduced Taras to his friends, to the Imperial Academy circle and the famous painter Bryulov, who at once decided that Taras must study at the Academy too. As a serf, Taras was ineligible to do this. Engelhardt proved unwilling to part with his talented protégé and finally only agreed to sell him his freedom for the almost prohibitive price of 2,500 silver roubles.

To raise this sum, Taras' new friends rallied round; Bryulov interested the celebrated poet Zhukhovsky who commissioned a Bryulov portrait of himself and had it auctioned by private lottery. On April 22, 1838 (a year after the death of Pushkin) Engelhardt received his 2,500 roubles; Taras Shevchenko became a free man for the first time in his life.

From the grime of Shirayev's garret he was transported to the enchanted halls of the Academy where his work won him acclaim and whence he graduated honourably in 1845. He made many friends in the open-hearted Bryulov circle, including the actor Shchepkin, and he began thirstily to fill the gaps in his education, absorbing all he could of literature and the arts, but underneath all his sophisticated activities he could not forget Ukraine, the sufferings of his people or the family he had left there unable to share his freedom.

There arose in him a new passion, to express all his homesickness and love for his country in Ukrainian verse. Years later he wrote of this period spent in Bryulov's studio in these words, "And what did I do in that holy of holies? It is strange to think of it. I occupied myself with writing Ukrainian verses ... I cherished in my heart my blind Kobzar and my bloodthirsty Haydamaks as in the shadows of the wild steppes I saw pass before me the shades of our good hetmen.

"Before me stretched the steppe, studded with burial mounds. Before me lay my fair, my unhappy Ukraine in all its chaste loveliness. And I mused, lost in thought; I could not tear my inner eye from that enchanting beauty. It was a vocation, that was all."

It was a vocation. In 1840 an enthusiastic Ukrainian merchant found Shevchenko's verses while sitting for his portrait in the artist's studio and immediately published them at his own expense. Shevchenko called the little book *Kobzar,* after the name of the old Ukrainian wandering folkbards. Keeping to the traditional folksong form and within the Romantic current of the day, he idealizes the stern and bitter conflicts which the Kozaks of old had waged for independence, glorifying the Kobzars who alone had kept alive the memory of Ukraine's heroic age.

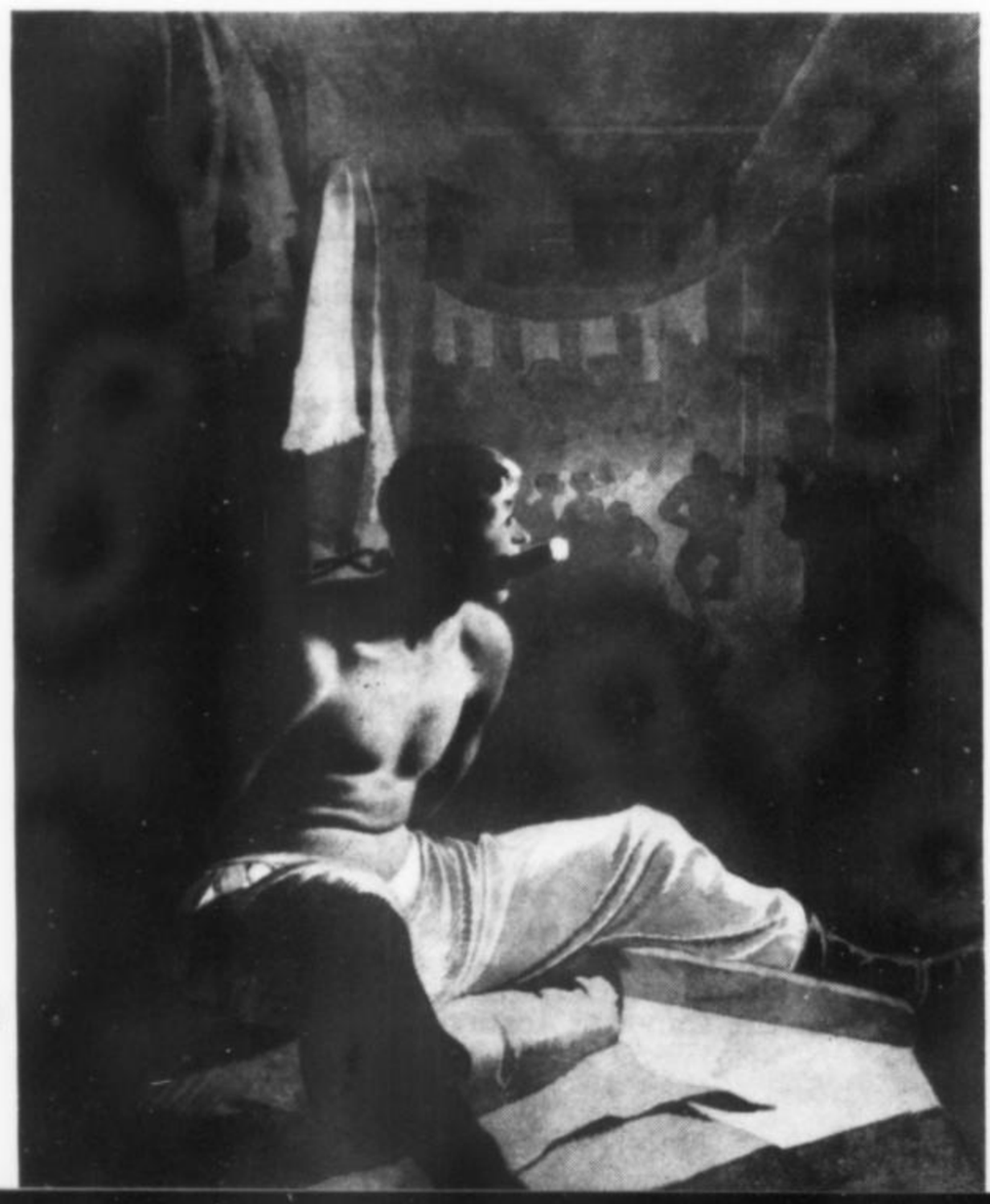
Kobzar marks an epoch and the beginning of a new Ukrainian literature; it throws a bridge between its ancient treasures, the later work of Kotlyarevsky, and modern literature. For the first time a major poet emerges to pour out his heart in his native tongue and express the sufferings of his people and their past. And because he lived so deeply in their thoughts and feelings, they accepted his poems as their own songs and composed music to them: today his works are in almost every Ukrainian home and are sung throughout Russia.

But his poetry is more than just folksong; it has the magic simplicity and melody of pure verse. "Owls are calling/ sleeps the forest/ stars are shining brightly ..." "Like the sea the field whitened/ by the driving snowflakes ..." Countless country images reflect the poet's mastery of his art. Together with this evocative lyricism, his poems are permeated with his innate humanism.

No one knew better than he the harshness of the peasant way of life. In the theme for instance of the village girl transgressing the moral code, he poignantly and repeatedly makes a plea for compassion and tolerance. In his long epic poem *The Haydamak,* which came out in 1841 and recalled the 1768 revolt of the Ukrainians against their Polish overlords, he writes "Why should people destroy each other? ... Only see, they are the same kind of people, they could live, they could be friends."

In 1843 he gave way to his intolerable longing and returned home to Ukraine; he was welcomed everywhere as a national poet, portrait commissions flowed in, all doors were open before him, but the terrible sufferings he saw among the peasants on his travels throughout the country brought about a sharp change in his work. His idealization of the Kozak epoch gave place to stinging

Shevchenko knew from his own personal experience the kind of harsh treatment meted out to political prisoners by authorities determined to crush the spirit of freedom. He wrote of it in his poems and depicted it in paintings like those below taken from his series entitled "The Prodigal Son", showing (left) punishment by the insertion of a heavy stick into the mouth to prevent speaking, and (right) the despair of prisoners chained together in a cell.



castigation of the enslavement, despotism and tyranny he saw everywhere exercised on behalf of the Tsar Nicholas I. He became openly rebellious to every institution, whether religious or civil, which seemed to tolerate such terror, cruelty and injustice as were suffered by the Ukrainian serf. He began a series of poems which from a literary standpoint are considered his most perfect. Politically they were dynamite ; they could not possibly be published in the Russia of that time and their circulation even in a private album which Shevchenko called *Three Years* figured greatly in his arrest in 1847.

Among these poems, *The Great Grave* recounts in mystical terms the immortal freedom-loving spirit; *The Dream,* written in a form of fantastic satire, contains an acid attack upon the Imperial family in which the poet ridicules the Court and likens the Empress to a dried mushroom; the whole poem is one of his bitterest attacks against tyranny.

"The people's loud cries and their laughs are not [heard ...
They strip the patched clothing from off of the beggars
They strip with the hides— for the poor must find shoes
For youthful young princes. They pummel the widow
To pay her poll taxes; they fetter her son
Her son, her one son, the only child that she has;
Her hope—and they send him away to the army
But for a while—yet in filth and in mud
The boy is soon bloated—from hunger he dies,
His mother is reaping the wheat at forced labour ..."

In another poem, *The Caucasus,* Shevchenko celebrates the struggle of the mountain people for their freedom. He sent this poem to Paris to the Polish revolutionary and poet Adam Mickiewicz, a follower of Mazzini, and it shows his widening interest in the cause of freedom not only in Ukraine but everywhere.

"And our human spirit dies not
And our freedom dies not ...
It is for us to keep on weeping
With bloody sweat and bitter tear ...
And mix each day with our daily bread
Truth will rise and so will freedom ...
And meanwhile the streams are flowing
Streams of blood are flowing."

At about this time appears the poem *The Feeble Minded* (Joridyvyi) in which Shevchenko, a contemporary of Abraham Lincoln, wrote
"When shall we receive our Washington,
With a new and righteous law
And receive we will some day ..."

In Kiev during this period he found sympathetic friends among a group of young Pan-Slavic revolutionaries called the Society of Saints Cyril and Methodius; their revolutionary ideals for peasant enlightenment and emancipation encouraged him to write *The Heretic,* a poem honouring the Czech reformer Jan Huss and glorifying him not so much as a great scholar but as a representative of the common people.

"Seer you caught the glimpse of freedom,
Freedom and of truth,
And the Slav wide-scattered family,
Sunk in dark and slavery,
You collected all together ..."

The existence of this Society was betrayed to the authorities in February 1847 and they acted swiftly and savagely suppressed it. By April Shevchenko and his friends were arrested and sent to St. Petersburg. In prison there the poet produced a number of verses in which he expressed his concern for the future of his country and the fate of his people. His main indictments were the "outrageous and to the highest degree insolent" poems and the *Three Years* album confiscated at his arrest.

On May 30 he was sentenced to serve as an ordinary soldier in the bare Orenburg steppe, "a broad, unlocked prison." On his sentence file papers Tsar Nicholas I wrote in his own hand, "under the strictest supervision with a prohibition of writing and sketching."

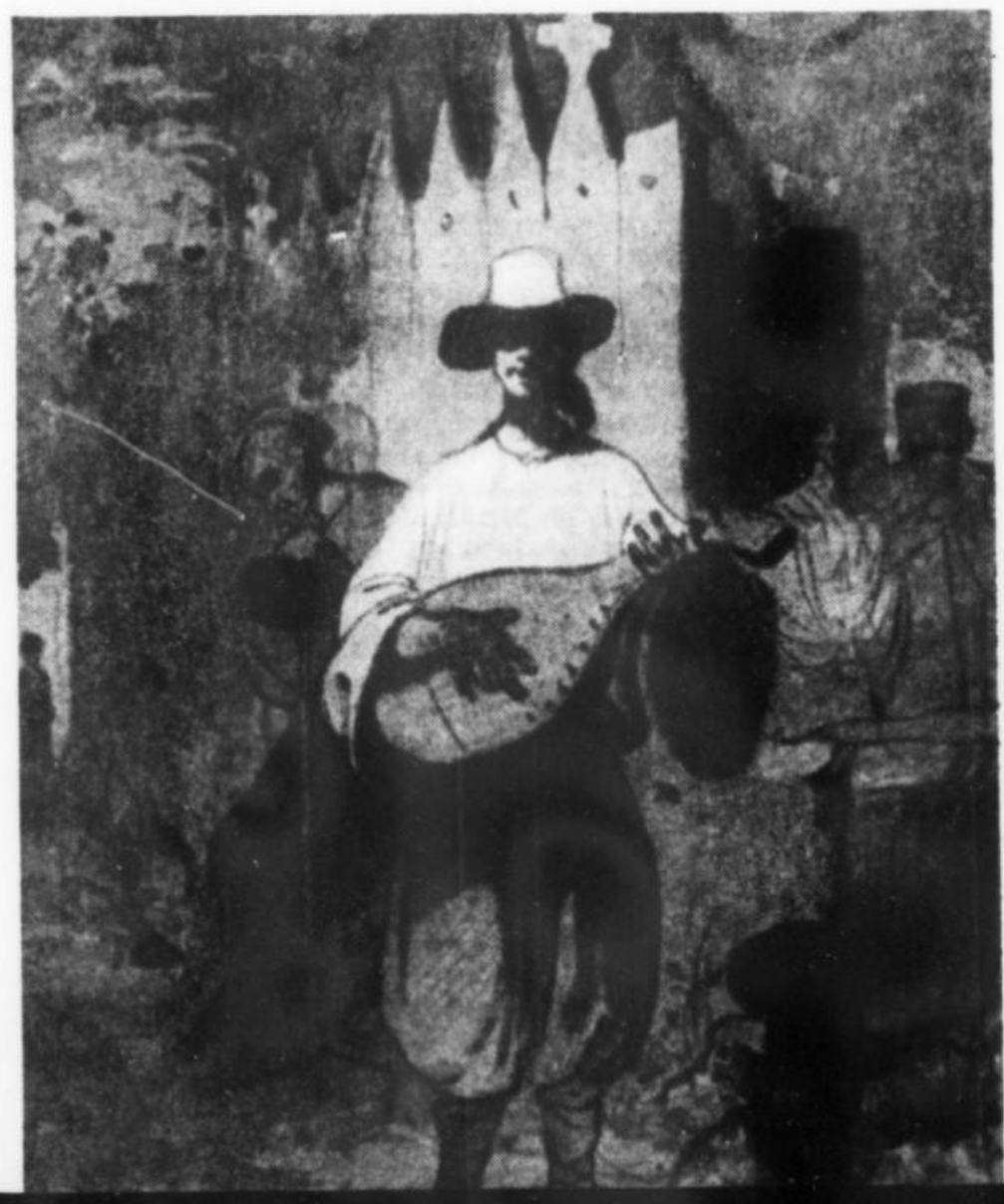
Shevchenko had been free for only nine years; now he was back in a bondage more terrible than before, torn away from Ukraine and condemned to live among rough and brutalizing soldiery in the remotest area of Eastern Russia. At first sympathetic officers allowed him clandestinely to draw and write,

"Am I to live in this sad plight,
Still many years, forever wasting ...
But I am looking, while my heart's flying,
To a dark garden in Ukraine ..."

When the St. Petersburg authorities got to know of this, the Tsar's instructions were carried out to the letter. Shevchenko was sent to a still wilder place, the fortress of Novopetrovsk on the Caspian Sea. Of this place he wrote, "Sand and stones; if only there were one blade of grass, only a tree, but nothing." The endless drill, the

CONT'D ON NEXT PAGE

From childhood Shevchenko showed a vivid imagination and a passion for drawing. As a serf he was ineligible to enter the Imperial Academy of Arts and was only able to do so after friends had bought his freedom for 2,500 silver roubles. Then the painter also began to fill in other gaps in his education and became a poet and writer too. Below, two of Shevchenko's works: left, an illustration for his poem "The Prisoner"; right, the village girl, Katherine.

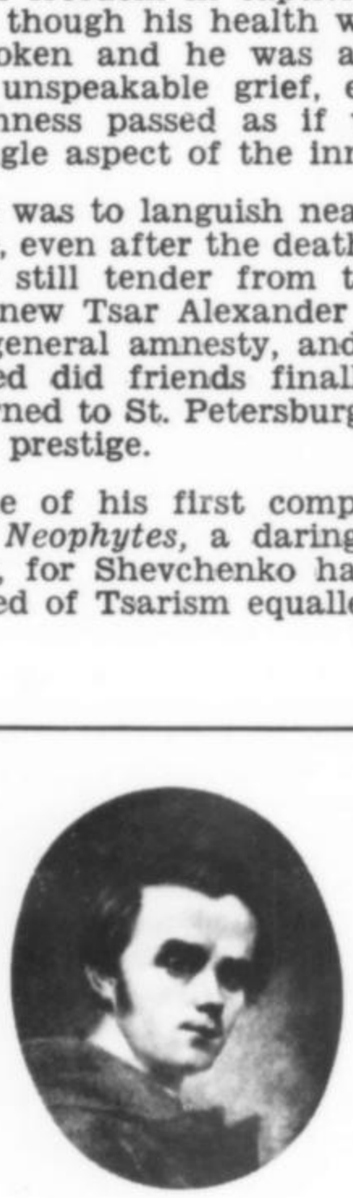


POWER AND PROTEST

absolute deprivation of any creative work or interests wore him away. "There is nothing more bitter than to recall freedom in captivity", he wrote at this time, but even though his health was affected, his spirit remained unbroken and he was able to note in his diary, "all this unspeakable grief, every kind of degradation and harshness passed as if without touching me ... Not a single aspect of the inner me was changed."

He was to languish nearly seven years in Novopetrovsk since, even after the death of Nicholas I, Imperial feelings were still tender from the "dried mushroom" episode. The new Tsar Alexander did not include Shevchenko in his general amnesty, and not until two years more had passed did friends finally secure his release, when he returned to St. Petersburg to enjoy great moral and political prestige.

One of his first compositions after being freed was *The Neophytes,* a daring comparison of the Tsar with Nero, for Shevchenko had returned from exile with his hatred of Tsarism equalled only by his hatred of slavery



Taras Shevchenko's first fame came as a painter, especially for his portraits (see self portrait at left). But his fame today rests with the poetry in which he captured the heart, soul and image of his native Ukraine. As early as 1860, translations of his poems appeared in Poland, and only a little later Czech and Bulgarian translations also appeared. In 1870, Georg Obrist translated his poems into German and six years later they were published in French. By 1903 his works were translated into English. In the past fifty years, Shevchenko's poems have been translated 400 times into 41 languages, numbering 12,000,000 copies. In the poet's native language, for Ukrainians around the world, his works have been published 245 times in almost seven million copies.

—for him these two evils were related and he never counted the cost in fighting them.

No other European literature has a comparable protest against serfdom and there is no other poet of genius sprung from the serfs who has shown up the ugliness of serfdom with such powerful effect as Shevchenko. He contributed much to the abolition of serfdom by influencing liberal public opinion which played a large part in inducing Alexander to initiate liberal reforms.

He interested himself in etching at the Academy, becoming an Academician in 1860, and achieving work which caused other artists to call him the "Russian Rembrandt." A Negro actor, Aldridge, came to the city and played Othello there: Shevchenko had always been deeply influenced by Shakespeare; he was much moved by Aldridge's performance and the two men became friends. And he continued to write, raising the flaming banner of his verse in the same causes of justice and liberty as before. Although he risked immediate retaliation, he did not hesitate to sign a statement defending the civil rights of the Jews which where in question, and he consorted openly with the leading radicals of the day,

King Lear and his Fool. Illustration by Shevchenko for a Russian edition of Shakespeare's tragedy.

including Chernyshevsky who spoke up for a new edition of *Kobzar,* which was allowed to be published in 1860 provided none of the post-exile poems were included in it.

But despite his valiant spirit, Shevchenko returned broken in body and weary from his exile. Personal unhappiness and loneliness weighed heavily upon him and his last poems, including *Mary* in which he deliberately changes the sacred story to that of an ordinary peasant woman, have more austere, often Biblical, sources; they carry a message emphasizing mankind's need for truth and love and brotherhood.

Against the day of peasant emancipation he wrote a primer for use in schools, but his very last poem is a swansong and a testament of faith that he will in another world..... "on Phlegethon, or on the Styx in heaven, or on Dniepro, that mighty river ..." find a happiness which this life denied him and which, towards the end, he most pathetically sought.

He died on March 10, 1861, and was buried as he had asked

"in a lofty tomb
out upon the steppes unbounded
in my own dear Ukraine;
so that I can see before me
the wide stretching meadows
and Dniepro, its banks so lofty,
and can hear it roaring ..."

His grave lies near the small town of Kanev where in 1939 a memorial was raised to him which has been called "an object of special reverence among his countrymen, the Mecca of all Ukrainian patriots." So it is, but this poet of Ukraine, who took his language as it had been developed, and by the power of his genius ensconced it in modern literature, this apostle of liberty, enemy of all oppression, Taras Shevchenko, goes beyond the narrow limits of one country. He is a poet of humanity; his message of brotherhood and love, truth and justice, and above all, of freedom, is worldwide in scope, universal in significance. Other poets have sung his song, other poets are perhaps better known, but none by the pure identification of his life with his inspiration deserves greater homage or recognition.

Letters to the Editor

CITY ON STILTS

Sir,

I read with great interest the article on the Canadian town of Aklavik situated inside the Arctic Circle in the permafrost zone. Soviet engineers in similar territory are building towns, settlements, factories, railways and roads, aerodromes and canals in our permafrost belt. The building is going on today on a very large scale and at high speed.

A good example is the town of Norilsk, about 100 kilometres to the East of the River Yenissei in Siberia and well beyond the Arctic Circle. The climate is much more severe than in Canadian Aklavik—the temperature drops to -50°C., accompanied by strong winds. Average annual temperature is -8.7°C. The permanently frozen layers within the town are from 80 to 150 metres thick.

Norilsk, beyond the Arctic Circle

Norilsk has been built literally in a few years; it only reached the status of a town in 1953 but already has a population of over 100,000 people of various nationalities. Its streets are lined with tall blocks of apartments with water, electricity, heat and other utilities. A heat-and-power station provides electric current and hot water for heating and domestic purposes.

The buildings are erected on ferro-concrete piles sunk 6 to 8 metres deep into the frozen ground; they freeze into place and become part of the permafrost. Under each building there is a hollow space allowing the free passage of air to preserve the frozen ground and prevent thawing. Water mains, drains and other communications are partly underground and partly above the surface, as at Aklavik.

The town possesses a TV centre, a drama theatre, four cinemas, two sports stadiums, a swimming pool, clubs, libraries (about thirty), schools, hospitals, etc. Communication with the outside world is by rail to Dudinka, a port on the Yenissei (the railway has been laid over permafrost), and by air from an airport some fifteen kilometres from the town.

Experience gained in Norilsk is being applied in other parts of the Soviet permafrost zone.

Sh. Akbulatov
Krasnojarsk, U.S.S.R.

PHOTOMICROGRAPHY OR MICROPHOTOGRAPHY?

Sir,

Upon reading your excellent edition of May, 1961, I felt that I had to write to you to correct a rather serious misnomer in your article entitled "The Invisible World". You were not discussing "microphotographs," a word used in the title of the article, and many times throughout, but "photomicrographs." A "microphotograph" is merely a small photograph; a "photomicrograph" is a photograph of an enlarged picture of an object, taken, for example, through a microscope. The subject under discussion, therefore, was "photomicrography", and not "microphotography" as stated in the title of the article. The term "microphotography" may be used in connection with micro-filming, or any process wherein the photograph represents a "reduction" in the size of the object.

I have always enjoyed reading THE UNESCO COURIER, and I wish you much success with future editions.

D.K. Edwards
Victoria, B.C. Canada

Ed. note: Technically our correspondent is correct but in common usage the two terms are synonymous. Both Oxford and Webster confirm this usage, the Oxford English Dictionary quoting 1858 *as the first date of the use of microphotography to mean photomicrography.*

THE RACISM ISSUE

Sir,

We are an "independent" theatre in Buenos Aires, i.e. one that is not subject to the limitations of the commercial stage. Last season, we produced and are still running a play "Hot Summer Night" by the English author, Ted Willis. This deals with the problem which now exists generally in London through the migration of Jamaican coloured workers to England.

To decorate one of the walls of our entrance hall and illustrate at the same time the subject of the play, we have used the material of your issue on Racism, as well as the letters to the editor on this subject, which you published in a later issue, letters which reveal the existence of the kind of prejudice that motivates the play.

We take this opportunity to tell you how much in agreement we are with the trend of thought expressed by your magazine, whose material is always of outstanding cultural and informative interest.

"La Máscara" Theatre
Buenos Aires, Argentina

Sir,

Many people are of the opinion that racial prejudice can be easily refuted through the publishing of results of scientific investigations which show potentially at least no difference between, say, white and black. This is all very well but it does not seem to take account of the complex of inadequate views which create racial tension and which the prejudiced fail to recognize as being part of their own way of thinking. For instance, there used to be a school of thought which considered the Negro as some sort of half-way stage between the "missing link" and "homo sapiens". Perhaps there is an unconscious acceptance of this view by the person who says of some African in the news "But hasn't he a high forehead!" I feel that an almost mentally purgative action would follow from publishing articles examining and criticizing the eccentric evolutionary theories and the pseudo-sociology on which the opinions of the racially bigoted now rest.

If racial intolerance is irrational, conversion from it may not follow from a parade of rational arguments condemning it. What is needed is an attempt at collective psychoanalysis so that the origins of present intolerance may be exposed.

W.A.C. Swan
Oxford, England.

VELAZQUEZ A LA PICASSO

Sir,

In your February issue there was a note on Velazquez in the Picasso Manner. I cannot understand how the image drawn by Picasso and disgustingly distorting Velazquez' picture demonstrates the "all-round talent" of that artist.

Will you please explain the point of view of those people (I know there are many of them) who consider such images to be works of art and allow them, as can be seen from the photographs on pages 7 and 11 of the same issue, to be reproduced even on the walls of the Unesco building.

In what does Picasso's talent consist? What benefit do his drawings, published in your journal, bring to people and what pleasure do they give?

M. Cherkasova
Secondary School Teacher
Moscow, U.S.S.R.

From the Unesco Newsroom

THIRTY-FIVE STATES SIGN 'ADDIS ABABA PLAN' FOR VAST EXPANSION OF EDUCATION IN AFRICA

TWO bold plans for the educational development of Africa were unanimously approved recently at a conference convened in Addis Ababa, Ethiopia, by Unesco and the U.N. Economic Commission for Africa. The first, a short term plan, aims to raise primary school enrolment in Africa from its present figure of 40% of the school-age population to 51% by 1966—from eleven million to nearly 15 million children. In addition secondary school enrolment should rise from 3% of the primary school population to 9%. This five-year project will cost an estimated $4,150,000,000.

The second plan, scheduled to take place over 20 years, provides for the establishment of universal, primary education throughout Africa by 1980, with 30 % of the children who complete primary schooling going on to secondary schools. This same plan allows for a tenfold increase of present university enrolment figures. Costs of the long-term programme should reach their peak in 1970 when total annual expenditures would amount to $1,790,000,000.

Both programmes form part of what has been called the "Addis Ababa Plan", signed by the representatives of 31 African states and territories and of four European powers with African responsibilities. The plan catalogues Africa's educational needs and lays down priorities for expanding secondary education, teacher training at all levels, the reform and adaptation of existing school curricula. It also lays greater stress on agricultural and technical education.

TO STAMP OUT MALARIA: Eradication of malaria, a priority goal for the World Health Organization (WHO), is "the greatest international health endeavour ever undertaken." To help finance it, WHO has suggested that member states issue anti-malaria stamps on World Health Day, April 7, 1962, under the slogan: "The World United Against Malaria." Countries issuing stamps may either contribute a percentage of the proceeds from their sales to WHO or donate stamps for sale.

■ **ARID LANDS & THE FUTURE:** *Arid and semi-arid regions are estimated to cover more than one-third of the earth's land surface; cultivated ground represents barely one-tenth. For each acre of cultivated land, three or four acres are practically unused by man because they are desert or covered with sparse vegetation. At its present rate of increase the world's population of* 2,700 *million will double in fifty years. Facts like these which add up to a major world problem are described and discussed by Professor Gilbert White of the University of Chicago, in "Science and the Future of the Arid Lands." This* 96*-page pamphlet, published as part of Unesco's Major Project for encouraging scientific research into the development of arid lands, can be obtained free of charge from Unesco, Place de Fontenoy, Paris* 7e.

TWO NEW UNIVERSITIES: A special committee has drawn up plans for a new European University to be located in Florence. It is intended that the university shall provide an international centre for post-graduate study either in fields inadequately covered by existing universities or in subjects which, in view of the current and future problems of a uniting Europe, need to be studied from a specifically European angle. In Nigeria a new university is to be built for students of the Western Region at Ife, 55 miles from Ibadan, capital of the region. Ife, whose name is derived from a word meaning "genesis" or "expansion", is the cultural cradle of the Yoruba people, the heirs of one of the oldest and most remarkable civilizations in this part of Africa.

■ BATTLE WITH BRINE: *Fresh water supplies in the Netherlands are being threatened by the infiltration of sea water, and canals irrigating more than* 1,300,000 *acres of land are becoming useless for this purpose as their increasing chlorine content is harmful to agriculture. The vast Delta Plan now being carried out to protect the land from flooding in the south will help to prevent the seepage, but in addition, the Netherlands will have to turn increasingly to fresh water supplies provided by rivers flowing into the country from the east, principally the Rhine. This in turn will require countries bordering the river to limit the amount of industrial waste released into its waters.*

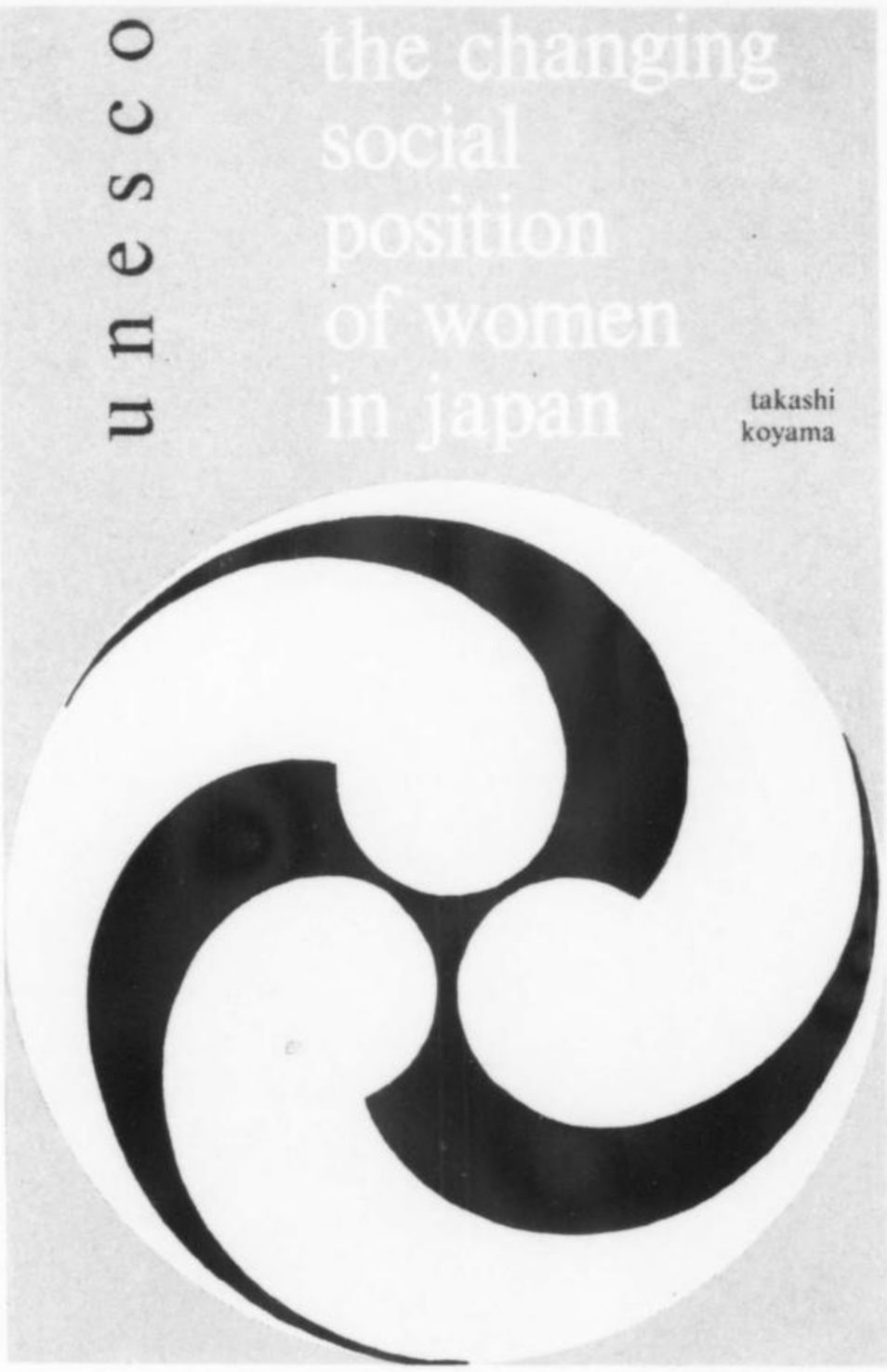
■ **JERUSALEM'S BIBLICAL ZOO:** *"The foxes, the little foxes that spoil the vines" mentioned in Solomon's* Song of Songs *have been brought back all the way from Australia to Jerusalem. But they have not been released in Israel's vineyards; they are now inmates of a zoo, unique of its kind, which now exists in a wooded park just outside Jerusalem, and which is reserved specifically for descendants of animals of biblical fame. Most of these mammals, birds, reptiles and fish are of local origin, but others like the little foxes had to be "repatriated". The biblical zoo has some* 700 *animals.*

HOUSE ON SPRINGS: An earthquake proof house, set on special shock absorbers, has been built at Ashkhabad, capital of the Turkmenian Socialist Soviet Republic. The walls do not touch the ground at any point, but are erected on reinforced concrete "cushions". The water pipes and drainage pipes are connected by flexible corrugated rubber muffs. The designer made use of the experience of the ancient Central Asian builders who erected huge buildings such as mosques on cushions of reeds.

THE UNESCO PHILATELIC SERVICE

The 30 cent stamp (shown above) is the latest addition to the series of regular stamps issued by the United Nations Postal Administration. It shows a collection of flags in red, yellow, blue, orange and green on a light grey background. These symbolize in design and colour the accompanying text, "To unite our strength" —one of the key phrases in the Preamble to the United Nations Charter. The new stamp is expected to be used primarily on air mail letters to Europe and North Africa, but it will also be employed for special delivery mail in the United States. This stamp and other philatelic items can be obtained from the Unesco Philatelic Service which has stamps and first day covers issued by member states to commemorate important events in the history of Unesco and the United Nations. As the agent in France of the U.N. Postal Administration, Unesco's Philatelic Service stocks all the United Nations stamps currently on sale. Information on items available will be sent on request by the Unesco Philatelic Service, Place de Fontenoy, Paris-7e.

Imp. GEORGES LANG, PARIS. IMPRIMÉ EN FRANCE.



Just published :

the changing social position of women in Japan

by Takashi Koyama

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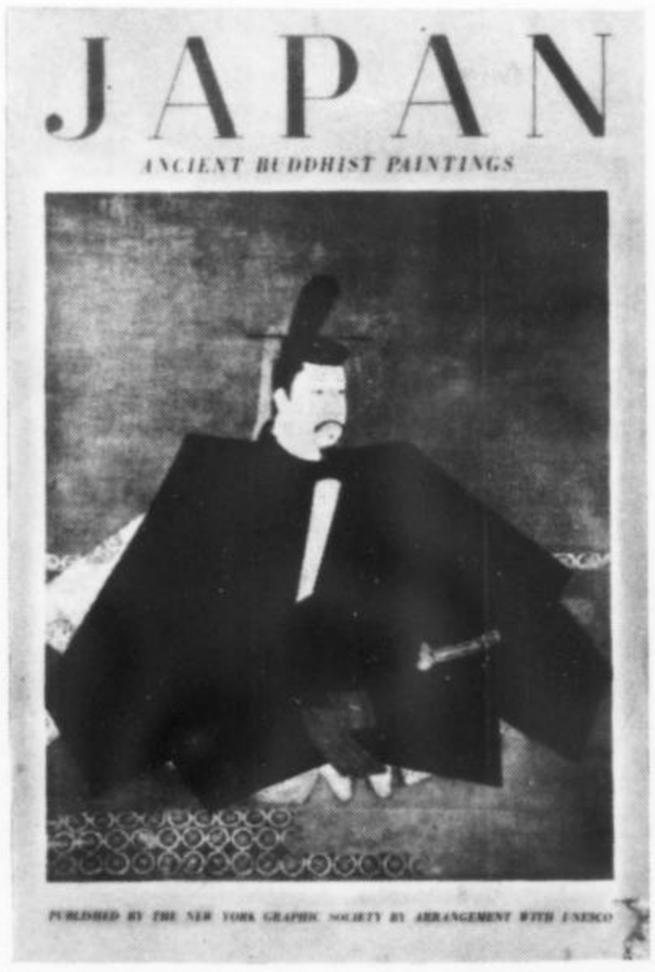

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